Community health centers in Indonesia in the era of decentralization

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The Impact of Structure, Staff Composition and Management on Health Outcomes

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The Impact of Structure, Staff Composition and Management on Health Outcomes

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Introduction

What makes health care systems effective in catering to the needs of their populations? Posing a key challenge for most industrialized countries, this question ranks high on the agenda of policy makers, politicians, and scholars alike (Perleth, et al., 2001). Many countries have put their hopes on decentralization as a means to improve the effectiveness and efficiency of the sector (Saltman, et al., 2007). However, many attempts to assess the performance implications of decentralization remain inconclusive (e.g. Bossert & Beauvais, 2002). This is not surprising since both decentralization and health care systems are complex, multifaceted phenomena and a large variety of factors affect their interplay (Regmi, 2013). The purpose of this dissertation is to shed light on the largely neglected organizational side of this phenomenon: the role of *community health centers* (CHCs). The four studies in this dissertation argue and show that variation in the structure, composition and management of these front-line organizations strongly affects health outcomes in their respective service coverage areas. The research problem of this dissertation can be summarized as follows: "How can variation in CHC innovation, efficiency, and efficacy be explained by CHCs' organizational characteristics and decentralized social contexts?"

The remainder of this introduction sketches the context of Indonesia's decentralized health care system, and describes CHCs. This is followed by an overview of the data sources. We conclude with a summary of the research problems and analytical strategies used in the four studies.

Decentralized health care in Indonesia

Indonesia is a huge archipelago with a population of some 237 million people (in 2010) inhabiting about 6,000 out of more than 17,000 islands. The country contains 34 provinces, 514 districts, and 7,024 sub-districts with each sub-district comprising sub-sub districts and/or villages (Pitriyan & Y.M. Siregar, 2013; WHO, Regional Office for South-East Asia, 2017). Providing accessible, effective and efficient health care across Indonesia is thus challenging.

According to critics of centralized health care systems, in such a context, a one size-fits-all system would be neither effective nor efficient to manage public health care provision (Mitchell & Bossert, 2010) given that each context requires specific health care programs, priorities, and strategies (The World Health Report , 2008). Decentralization has therefore been promoted as an instrument for adaptable public service provision in health care (Bossert, 1998; Jimenez-Rubio, 2011). By transferring central government authority to local governments or districts, local authorities gain the discretion to develop and implement public health programs, allocate budgets (Jimenez-Rubio, 2010), and initiate innovation in health service programs, all with the aim to achieve responsiveness in health care in accordance to local community needs (Bossert, 1998).

In 1998, Indonesia made the first steps on this decentralization path as part of a reform movement after the collapse of the authoritarian regime. The first decentralization phase began in 2000 and consisted of considerable shifts in political, fiscal and administrative power from central government to regional and local levels of government. This first decentralization phase transformed the country from an authoritarian-centralized to democratic decentralized system (Holzhacker, et al., 2016).

However, it soon transpired that this phase of decentralization had unintended consequences, such as the rise of regional inequalities and disparities (Prud'homme, 1995), coordination problems between regions (Maskin , et al., 2000) and corruption (Bardhan & Mookherjee, 2005). These problems may stem from variation in districts' capacities and resources, as well as from diverging program preferences and elite or group interests at the local level (Vrangbæk, 2007).

Coordination problems and local government inequalities led to an effort of recentralization in Indonesia's second phase of decentralization in 2004, in which the central government regained the authority to stipulate standards, control local government regulation, and decide on programs. This was partly achieved by the fact that the central government regained the authority to decide on the allocation of budgets to the local government level, thereby assuring implementation of the national program at local levels. For example, the central government proposed strategies to provide equal health facilities across local governments, increase coordination between regions, and enable accountability of the regional level to the central level (Holzhacker, et al., 2016). The system of shared decision making and responsibilities that emerged can be labeled as a multi-layered decision-space in which different government actors and levels cooperate and have different responsibilities (Saltman, et al., 2007).

Since 2004, this multi-layered decision-space has also been formally established in the health care sector by means of various laws such as the law on the Health System in Indonesia (Law 36/2009), the Ministry of Health Decree on CHC Organization (Decree 128/2004), and the Ministry of Home Affairs' Decree on the *Posyandu* Reinvention (Decree 411/2001) as amended and strengthened by a recent Ministry of Health decree (Decree 19/2011). These laws defined the precise tasks and

responsibilities of central and local government regarding health care. The central government (Ministry of Health) stipulates the national health programs and strategies, determines the standards for health care provision, monitors health care organizations, services, medications, and professions in the country, and coordinates the health sector at the national level. Local governments are responsible for designing regional health care programs and strategies based on national health programs and strategies. They are also responsible for providing health services to the community, and coordinating the implementation of health program strategies at the local government level.

Many developing countries have embarked on comparable decentralization paths in the health care realm. Scholars claim that these decentralization initiatives are mainly politically driven (Litvack, et al., 1998), based on theoretical assumptions with scarce empirical evidence of the actual results and impacts (Vrangbæk, 2007; Bustamante, 2010). A decentralized system is believed to be promising for various reasons. First, decentralization is assumed to be more cost effective and higher in allocative efficiency because it can offer tailor-made solutions and services. Local or regional governments can recruit public officials in health care from local citizens who comprehend the context and the problems of the community, which improves program implementation (Vrangbæk, 2007). Second, decision makers are closer to the community and therefore transaction costs will be reduced (Tiebout, 1956). Third, decentralization is also expected to reduce inequalities within areas, since it allows greater participation of local communities in program implementation and financing as well as greater integration of the activities of different public and private agencies (Vrangbæk, 2007). Finally, decentralization can also improve inter-sectoral coordination, particularly between local government and rural development activities (Vrangbæk, 2007).

However, there is little concrete evidence that helps to answer the question whether the potential benefits of decentralization are realized, particularly in developing countries. Few developing countries have long-term experience with health sector decentralization, and its impact on health outcomes have seldom been evaluated (Bustamante, 2010). Thus, little is known about the degree to which decentralization really fosters equity, efficiency, accountability and quality in the health sector. This also holds for the Indonesian case. This dissertation therefore investigates how the health care sector in Indonesia performs in this second phase of decentralization.

Community health centers in the Indonesian health care system

CHCs are argued to be capable of achieving responsive health care provision in Indonesia's decentralized health care sector because they are closest to the population and thus best able to adapt to the changes and challenges that are unique to their service coverage area (Bossert, 1998; Saltman, et al., 2007). Local governments therefore delegate authority to particular CHCs, aiming to enable efficient, effective and innovative health care (Bossert, 1998; Mitchell & Bossert, 2010; Saltman, et al., 2007).

CHCs in Indonesia are government health institutions at the sub-district level. In 2011, the year of study central to this research, there were 9321 CHCs, spread over 6773 sub-districts all over Indonesia. The government regulates the establishment of each CHC. This regulation mandates that CHCs have a minimum of four functions. First, they provide primary health care, as the front-line health institution that community members can visit first when they have health problems. The second function is to provide mother and infant care, including antenatal and postnatal care. The third function is to assist in preventing infectious diseases, for example through immunization programs, and to provide immediate care in the case of outbreaks of infectious diseases. The fourth function is to conduct health promotion by providing information to the community about healthy lifestyles, including contraception use to prevent unplanned pregnancy (Ministry of Health Decree No.128 / 2004 on *Puskesmas* CHCs). If patients require more complex care, the CHC will transfer them to hospitals or other referral services.

In order to reach communities at the village level, CHCs are allowed to open a spatial unit, called a *branch,* in each village. CHCs may also collaborate with community-based organizations, the *Posyandu*. In addition to CHCs, local government and private and public organizations may provide health care to communities. Figure 1.1 presents the position of CHCs within the Indonesian administrative jurisdiction.

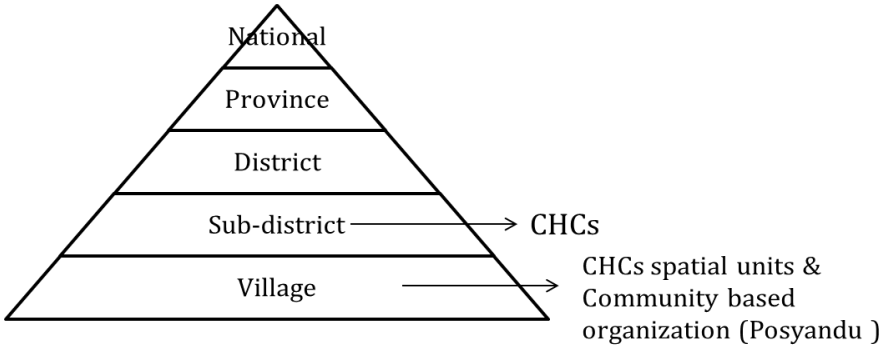

Figure 1-1 CHCs within Indonesian administrative jurisdiction

CHCs can differ in many ways. For example, they can request mobility facilities (e.g. boats and motorcycles) to transport health staff to remote areas. CHCs can also vary in the number of horizontal units. They can have inpatient care facilities (CHCs with beds), a 24-hour facility for obstetrics neonatal care (also called *Poned*), and/or an ambulatory service. CHCs can voluntarily participate in providing health care services in *Posyandu* on the village level.

The central government determines the requirements that need to be met for additional functions to be granted. For example, a CHC may have inpatient care if the sub-district where it functions is distant from a referral service (e.g. a hospital). The central government stipulates that each CHC should employ at least eight kinds of staff: one or more physicians, dentists, midwives, nurses, pharmacists, public health workers,

nutritionists, and environmental health workers (2004 and 2015 Ministry of Health Decree No. 128 on *Puskesmas* (CHCs)).

Decentralization and CHC performance: research questions and framework

This book contains four empirical studies on Indonesian CHCs and their capacity to generate high performance in health outcomes in the context of decentralization. In other words, this study asks if and how CHC discretion and autonomy in Indonesia's decentralized era are related to their performance: Are performance differences between CHCs negligible, now that they have the discretion to tailor their operations to local circumstances, or do CHCs differ considerably in performance. If so, how can this be explained?

This dissertation focuses on four organizational dimensions of CHC discretion that resulted from the multi-layered decision-space. We relate these to specific outcomes of CHC activities, leading to the following combinations of organizational dimensions and health care outcomes: 1) the effect of CHC decision-space use on innovation; 2) the effect of CHC organization design on efficiency; 3) the effect of variations in CHCs' skill mix of professionals on efficacy and 4) the effect of CHC collaboration with community organizations on the percentage of children weighed (efficacy). Each dimension is represented in an empirical study (see Figure 1.2). Overall, the central research question in this book is thus: How can variation in CHCs' innovation, efficiency, and efficacy be explained by CHCs' organizational characteristics and social contexts?

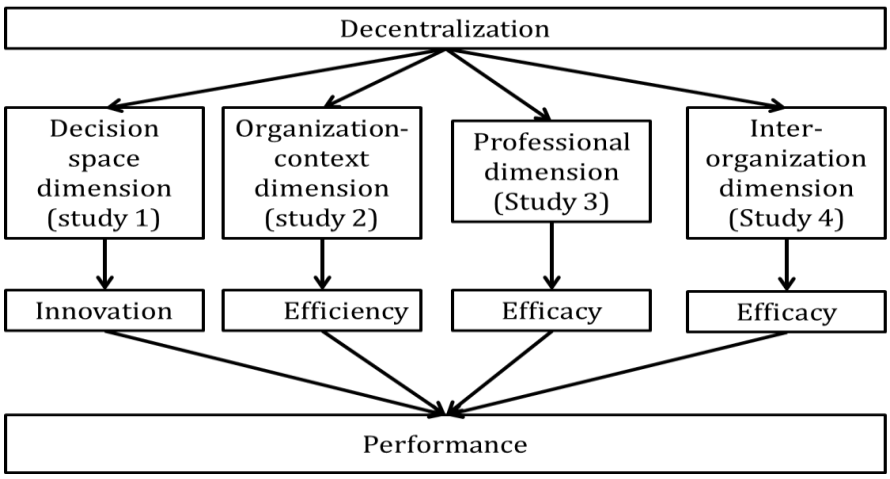

Figure 1-2 Decentralization-performance framework

In the next sections, we first give an overview over the research design and data, before discussing the four studies.

Data and information sources

Data on the characteristics and performance of CHCs was retrieved from various sources: government regulations, social media, interviews and reports.

Analysis of government regulations and social media information

We analyzed a variety of documents. First, and particularly for the first study, we analyzed government regulations to compare the degree of decision-space and the strength of the accountability mechanisms. In the second study, we also analyzed government regulations regarding the conditions in which a CHC can have certain structural characteristics, such as a 24-hour emergency unit, or how many skills should be present in a CHC.

Second, we studied social media sources comprising information on CHC practices. In the first study, we analyzed social media posts about CHC innovation practices created by CHC staff, or officially owned by the CHCs. Generally, CHC practices vary across sites, but this information is often not well documented. For example, some job descriptions of the various CHC positions could only be found on social media, written by health staff themselves. We used this information especially in the third study.

Expert interviews for background information

We used interviews with experts to collect additional information. The experts in this study are CHC directors with specific, exclusive knowledge that helped us understand the context of CHCs and how they operate in practice. The interviews were conducted twice. First, at the beginning of the project before the series of studies were designed, we conducted one interview with a CHC director, to assure the relevance of the formulated research problems, also in relation to the challenges that CHCs faced at that time. We also discussed the relevance of using secondary data. Halfway through the project, we conducted four expert interviews to discuss the results of the second paper, especially with regard to results that contradicted our theoretical expectations (Bogner & Menz, 2009). Two directors of CHCs in remote areas in Lombok Barat regency were interviewed, alongside two directors of CHCs in non-remote areas in the Tangerang Selatan regency. These interviews were also used to gain background information for the third and fourth studies.

Dataset of 589 CHCs

For the second, third, and fourth study, our dataset comprised a sample of 589 Indonesian CHCs. Data on CHC health performance in Indonesia are hard to find because of their wide geographical dispersion and the under-developed information management infrastructure in the Indonesian health sector. This study is therefore based on a relatively small sample of 598 CHCs in 2011 (then 6.4% of the total population of CHCs). The year 2011 was chosen because it was the most recent year for which most information in these two data sources was available. We combined two data

sources to create this sample. First, we retrieved CHC data for 2011 published on the official Ministry of Health website. This data includes information on (1) the number and types of CHC health professions, (2) the number of organizational units in terms of horizontal and spatial differentiation, and (3) whether the CHCs is located in a remote area or not.

Second, we combined this information with data retrieved from 37 district health profile reports published in 2011 by the Department of Health. Since 2005, districts are expected to provide an annual health profile report. However, not all districts comply, and only a small fraction publishes the report on their websites, which limited the number of available reports. The reasons why some CHCs do not publish a health report are not known, but it might have to do with a lack of capacity to create such a report.

These reports present information per CHC. Data collection was arranged and coordinated by the Ministry of Health through the Department of Health in each district. The Ministry of Health determined the data collection instruments, indicators, and structure of the report in order to ensure the level of uniformity necessary for aggregating information to the provincial and national level. The report has three parts. The first describes the context of the region in terms of population size and number of infants, for example. The second provides information about health care services and community health conditions, such as the number of visitors, vaccinated infants, attended deliveries, contraceptive users, and the frequency of promotion activities. The third provides information about the health institutions, for example, the number of health staff in CHCs and number of hospitals.

Our data is on 2011, the most recent year for which most health profile reports were published (47 with information about 735 CHCs). Some reports were downloaded from the official Ministry of Health website, others from district websites.

Four studies on Indonesian Community Health Centers

The four studies in this book build on previous academic work on CHC performance. We reason that in order to comprehend CHC performance, we need to consider the characteristics of both the CHC organization and the health system. The remainder of this introduction summarizes the research questions, and the theoretical and empirical approach of each study. Table 1 provides a summary overview.

Study 1: Community health center innovation and decision-space use

The upper layer institution – the Ministry of Health (MoH) – defines national health goals (e.g., decreasing maternal mortality in 2005) and strategies. At the organizational level, CHCs have the decision-space to define how they would like to translate national strategies to organizational strategies and programs. The use of this organizational decision-space is expected to enable CHCs to innovatively respond to community health problems and needs, and tailor services to their specific context condition. However, the presence of decision-space does not necessarily guarantee that innovation happens.

Thus, the central question of the first empirical chapter is *under which conditions does decentralization of the Indonesian public health sector favor innovation at the district and organization (CHC) level.*

We use *a decision-space approach*, a theoretical framework developed to analyze the effects of decentralization (Bossert, 1998; Mitchel & Bossert, 2010; Bossert & Mitchell, 2011). We theorize that decision-space combined with appropriate accountability mechanisms will lead to innovation practices to improve health performance (Mitchell & Bossert, 2010). Decision-space is defined as embedded in CHCs, and the accountability mechanisms refer to the arrangement of relationships between different actors in the health system, such as other organizations in different sectors and domains (legislative body).

This study investigates how the two large-scale decentralization waves in Indonesia affected the processes, product, and structural innovations in its primary health care system. Indonesia's two waves of decentralization create the opportunity for a detailed comparative examination of how different institutional arrangements may affect health care innovation in the same socio-cultural context. We use the tools of *comparative institutional analysis* to map how key institutional dimensions in the health sector changed from the first to the second wave of decentralization. *Policy documents* and *administrative regulations* are our major sources for applying this framework to the Indonesian case. Given the paucity of health care innovation in the Indonesian system, we submit the few cases where innovation reportedly did occur to closer scrutiny. The purpose of this case analysis is to uncover possible commonalities in the conditions for and the pathways to innovation during both waves of decentralization. Our main data sources for this step are *earlier case study descriptions* and *media accounts*.

Study 2: Community health center organization efficiency, design and context

The upper layer institution also determines the requirements needed to establish a CHC. A CHC should be present in areas ranging between 30,000 and 60,000 citizens. The central government regulates the basic organizational structure of a CHC. For example, CHCs are allowed to have branches at the village level, or to have an inpatient care unit if the next hospital is far away.

At the organizational level, CHCs have their decision-space to propose their structures and allocate their budgets, within some limits. For example, CHCs can expand their structures based on demographic considerations, such as the population size of their service coverage area. The MoH also allows CHCs to have spatial units unlimited in quantity. Hence, CHCs can have branches in villages, thereby organizing health care even closer to the people. The same goes for horizontal units, such as a 24-hour care unit or an emergency room, but here approval from the upper level institution is required.

We expect that CHCs will adapt their organizational structures so that they fit with the specific context of their service coverage area, resulting in more efficient CHCs,

meaning that some CHCs will achieve better results with the same input. The second empirical chapter therefore asks: *Is there variation in CHCs' efficiency in Indonesia, and if so*, *how can CHC organizational characteristics and context explain this variation?*

Drawing on *contingency theor*y reasoning, we apply *a context-design performance framework.* It assumes that the structural compatibility of CHCs to their social context determines their efficiency (Marathe, et al., 2007). The concept of structural compatibility refers to a CHC's internal organizational characteristics, particularly its degree of horizontal and spatial differentiation. The social context refers to the characteristics of the service coverage area, such as poverty and remoteness.

This study investigates the impact of CHC organization design and context characteristics on CHC efficiency. To generate the dependent variable (efficiency score) the study uses *data envelopment analysis* (DEA) to estimate the efficiency of 598 CHCs in Indonesia. Given that we consider only the efficiency with which given inputs are processed into outputs and do not analyze whether the cheapest inputs are used and the most profitable outputs are produced, our efficiency concept is what scholars in this field call "technical efficiency".

DEA is an analytical tool to benchmark an organization's performance to the maximum attainable performance of similar organizations (see Farell, 1957; Charnes, Cooper and Rhodes, 1978; Pelone et al., 2015). This maximum attainable performance is estimated by applying linear programming methods to a sample of organizations that use similar inputs to produce similar outputs. One advantage of DEA is that it can deal with multiple inputs and outputs. With this method, organizations (often-labeled DMUs, "decision-making units") are only benchmarked against the maximum performance of organizations that use the inputs and outputs in roughly the same way (Coelli, et al., 2005). A second major advantage of DEA is that it can be used without information about the price of inputs and outputs. Reliable information, particularly on output prices, is often lacking in the context of public organizations like the CHCs we study.

The study uses *Tobit regression analysis* to analyze the relation between vertical, horizontal and spatial differentiation and context characteristics (poverty, remoteness) on CHC efficiency. Tobit regression analysis is regularly used to analyze variation in technical efficiency (Marschall & Flessa, 2011; Cordero Ferrera, et al., 2014; Pelone, 2015; Varabyova & Müller, 2016). Tobit regression removes bias that would result from applying a standard linear regression framework to analyze truncated dependent variables (such as DEA efficiency scores that range from 0 to 1) (Simar & Wilson, 2007; Tobin, 1958).

Study 3: Community health center efficacy and skill-mix of professionals

Ministry of Health Decree No. 128/2004 lists eight types of health staff professions (skill mix) that must be available in each CHC: doctors, dentists, midwives, nurses, nutritionists, pharmacists, public health officers, and sanitarians or environmental health officers. This range of professions is formally required, based on the assumption

that the kills these professionals possess are necessary for CHCs to realize their four basic functions (see 1.2).

The lower level institutions (CHCs and district offices) have decision-space to propose the inclusion of additional health professions to the CHC staff. In the collected data (2011), a CHC's health staff ranges from two to ten professions, with more than 50% of the sample failing to meet the minimally required skill mix of eight professions. This variation of skill mix implies that some CHCs lack the capacity to carry out their four core functions. The research question of the third empirical paper is therefore *which combination(s) of skills (defined as professions) lead(s) to high efficacy in Indonesian CHCs?*

We build on earlier skill-mix research proposing that the variation in skill-mix configurations in a health sector organization can explain variation in performance. This literature also postulates that *substitution and complementarity* are two mechanisms that explain the relation between skill-mix configurations and the performance of health care organizations (Buchan & Poz, 2002; Misangyi & Acharya, 2014). We propose that CHCs with a lower skill mix than standard will still be able to perform optimally due to the substitution mechanism.

In this exploratory study, we inquire which combination(s) of skills (defined as professions) lead(s) to high efficacy in Indonesian CHCs. We do not focus on the number of professions present in the skill mix, but consider the configuration (or: composition of the types) of professions that lead to high CHC efficacy. We define four efficacy indicators, representing outcomes of the four CHC functions: primary health care, mother and infant care, preventing infectious diseases, and health promotion activities. We use the data set of 598 CHCs derived from health profile reports published in 2011 for the efficacy variables.

We divide the possible range of staff positions over the four functional domains, depending on who has prime responsibility to execute the tasks in this domain (based on an analysis of *job descriptions*). Furthermore, we investigate what mechanisms explain the relationship between skill mix and high CHC outputs (efficacy). We analyze *job descriptions* to derive expectations about which staff members could substitute for each other.

The study uses fuzzy-set *qualitative comparative analysis* (QCA). This method is pertinent to our study for three reasons. First, it allows a formal, transparent comparison of CHC outputs in our sample in relation to different combinations of causal conditions—in our case, variations in skill mix. Second, QCA allows for analyzing 'equifinality', meaning a "situation in which the same outcome may follow from different combinations of causal conditions" (Ragin & Davey, 2016; Rihoux & Ragin, 2009). This is important for our study given that potentially multiple pathways to high CHC performance (Schneider & Wagemann, 2012; Rihoux & Ragin, 2009). Third, QCA provides options to analyze mechanisms of substitution and complementarity (Misangyi & Acharya, 2014). The analysis can show which health professions are essential and which contribute to the expected performance.

Study 4: The co-production between Community Health Centers and Community Organizations

Monitoring the weight of children is crucial to detect malnutrition early. To weigh children in Indonesia's challenging demographic and geographic circumstances requires collaboration between CHCs and community-based organizations. This study analyzes this collaboration and its effect on the number of children that are weighed.

Two decrees by the Indonesian Ministry of Home Affairs and MoH mandate CHCs to collaborate with *Posyandu* in providing health care services. *Posyandu* are community-based organizations that are expected to be present at the neighborhood level. They help CHCs reach out to the community. CHCs have the decision-space to activate *Posyandu* in order to co-produce health care services with them.

The study categorizes three types of *Posyandu*, based on the strength of their human resource base, their scope of activities and member base, and their degree of autonomy: strong, intermediate and weak *Posyandu*. The fourth empirical paper asks *if and how specific CHC characteristics and the type and number of Posyandu relate to the number of children weighed in a community,* as an example of one particular health care output (efficacy).

This study builds upon an *organization-community relation perspective* and a *service co-production perspective*. We expect that CHCs that operate in areas with strong *Posyandu* will be more effective in reaching the population to have their children weighed, compared to CHCs that do not work in areas with strong *Posyandu*. However, we assume that the performance in this domain also depends on how well CHCs organize themselves internally to reach out to local communities (Subramony, 2017).

Consequently, we propose that the number of children being weighed has a positive relationship with certain CHC characteristics (numbers of midwives, branches and promotion activities) and the number of strong *Posyandu* that co-produce the service. Moreover, we expect a positive interaction effect of CHC characteristics and the presence of strong *Posyandu*. We compiled an archival data set from 37 local government reports on CHC health profiles published in 2011 and applied *negative binomial analyses* to test our hypotheses.

Table 1-1 Summary of research questions and research design of the studies

Study	Research Questions	Theory and variables	Methodology and data source
1	Under which conditions does decentralization of the Indonesian public health sector favor innovations at the district and organization (CHC) level?	Theory: Decision-space approach Dependent variable: innovation evidence at district and CHC organizations Independent variables: (1) Degree of decision-space in fiscal, administrative and political dimensions, and (2) The strength of accountability mechanisms (upper, horizontal, and lower accountability mechanism)	Data: Government regulations on the decentralization, law and regulation on health care, published papers and media on CHCs innovation cases Methodology: comparative institutional analysis of the decision-space and accountability mechanisms between two different decentralization eras in Indonesia
2	What variation is there in CHC efficiency in Indonesia's decentralized health care system, and if so, how can it be explained?	Theory: Context-Design Performance Framework: organizational performance is dependent on the compatibility between organization design (structure) and the context Dependent variable: the relative technical efficiency score of CHCs Independent variables: (1) Horizontal and spatial differentiation, and (2) Organizational context (poverty rates and remoteness)	Data: 598 CHCs, compiled manually from Health profile of local governments, and basic data on CHCs information provided by MoH year 2011, Interview with four CHC directors, (2 from CHCs in non-remote areas and 2 from CHCs in remote areas) Methods (1) Data envelopment analysis to generate the dependent variable (2) Tobit regression analysis to analyze the association between organization design and context and efficiency
3	(1) What skill-mix configurations relate to high CHC efficacy across a number of health outcomes? (2) To what extent and how do substitution or complementarity mechanisms explain the relationship between skill-mix and high CHC outputs?	Theory: Skill-mix configuration Dependent variables: efficacy in terms of (1) vaccinated infants, (2) attended deliveries, (3) providing promotional information and care to contraceptive users, (4) other primary health care services. Independent variables: the presence or absence of (1) doctors, (2) midwives, (3) nurses, (4) dentists, (5) pharmacists, (6) public health, (7) nutritionists and (8) nutritional health staff in CHCs	Data: 598 CHCs from 37 districts, compiled manually from Health profile of local governments, and basic data on CHCs information provided by the Ministry of Health both in year 2011, Methodology: Fuzzy-set Qualitative Comparative Analysis
4	If and to what extent does variation in the characteristics of CHCs and *Posyandu*, individually and interactively, explain variation in the number of weighed infants and children in Indonesia?	Theory: Organizational – Community Co-production relations Dependent variable: number of weighed infants and children under 5 years Independent variables: (1) CHC characteristics related to endeavors to engage the community organization to co-produce (number of midwives, branches and promotional activities, (2) the number of strong *Posyandu.*	Data: 598 CHCs from 37 districts, compiled manually from Health profile of local governments, and basic data on CHCs information provided by the Ministry of Health both in year 2011, Methodology: Negative binomial regression analyses

TWO

Community Health Center Innovation and Decision-Space Use[1]

Abstract

A well-functioning primary health care system (PHCS) is fundamental for a nation's overall health performance. PHCSs are designed to improve universal access to health care, which likely leads to healthier communities, higher quality of care, and a more effective and efficient health care system. The present chapter investigates how the two large-scale decentralization waves in Indonesia affected the processes, product, and structural innovations in its primary health care system. We argue that adequate organizational capacity and local level innovations are a major requirement to improve the performance of a PHCS. The study uses the decision-space approach to analyze the impact of decentralization on the decision-space, accountability mechanisms, and organizational capacity to facilitate health improvement. To achieve the aim, first, the study uses institutional analysis to describe the transformation of the decision-space and accountability mechanism from the first and second waves of decentralization based on changes to laws and regulations. Second, the study investigates the sequence of innovation of PHCS by analyzing studies on cases of innovation in the two waves of decentralization. The study found the first wave of decentralization in Indonesia configured institutional changes that were detrimental to innovation, because although discretion for local level decision makers increased compared to the situation under the former centralized system, requirements for accountability did not. This pattern was reversed during the second wave of decentralization, suggesting that the conditions for innovation improved. The cases of successful innovation share a specific combination of initiative, commitment and social capital of a key decision maker as a fundamental enabler of innovation.

Kew words: Primary health care, decentralization, local government, innovation, decision-space, accountability mechanism, and organizational capacity.

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Introduction

A well-functioning primary health care system (PHCS) is a fundamental precondition for a nation's overall health performance. PHCSs are designed to improve universal access to health care, which in turn leads to healthier communities (Starfield, Shi, & Macinko, 2005), higher quality of care (Kringos, et al., 2010), and a more effective and efficient health care system (Kruk, et al., 2010). Consequently, many countries conduct public health reforms in an attempt to strengthen their PHCS (OECD, 2012). Such reforms in the health sector are often embedded in a broader context of large-scale decentralization (Bossert T., 1998; Jimenez-Rubio D., 2011; Trubek & Das, 2003). However, relatively little is known about how decentralization affects the performance of a PHCS.

The present chapter investigates how the two large-scale decentralization waves in Indonesia affected one specific aspect of the country's health sector performance: its potential to introduce process, product, and structural innovations in its primary health care system. We argue that local level innovations are a major requirement to improve the performance of a PHCS. Drawing on an in-depth analysis of institutional changes between the two phases of decentralization and selected case studies, we show that the first wave of decentralization in Indonesia actually resulted in institutional changes that were detrimental for innovation. Whereas discretion for local level decision makers increased compared to the situation in the centralized system, requirements for accountability did not. This pattern was reversed during the second wave of decentralization, suggesting that the conditions for innovation improved. The rare cases of innovation occurred in both waves share a specific combination of initiative, commitment, and social capital of a key decision maker.

In theory, decentralization enables public sector decision makers and providers to responsively adapt to dynamic and changing local conditions (Arrow, 1963), particularly in highly complex settings like the health sector (Plsek & Greenhalgh, 2001; Mitchel & Bossert, 2010). In practice, decentralization is a multi-dimensional phenomenon that complicates an assessment of its impact on health care performance (Jimenez-Rubio, 2010; Martínez & Rodríguez-Zamora, 2011). At least three policy domains are at the core of decentralization efforts (Cheema & Rondinelli, 2007). First, administrative decentralization increases the local government's policy-making power. Second, fiscal decentralization entitles local governments to collect revenue and decide about its allocation. Finally, political decentralization in the form of direct elections of the head of the local executive body significantly increases community members' voice and influence on the local political system (Cheema & Rondinelli, 2007).

Despite the multi-dimensional nature of this phenomenon, most studies focused on the impact of fiscal decentralization only, arguing that fiscal decentralization is the best indicator to measure the degree of decentralization (Jimenez-Rubio, 2011). Many of these studies have indeed found a positive relationship between the degree of fiscal decentralization and a variety of health outcomes. For example, fiscal

decentralization reduced infant mortality in several countries, including China, India, and OECD countries (e.g. Jimenez-Rubio, 2011). Other studies showed that fiscal decentralization can have positive effects if specific conditions are present, like an institutional capacity to respond to local ethno-linguistic fractionalization (Robalino, et al., 2001), recruitment of more physicians (Cantarero & Pascual, 2007), and improved socio-economic condition of localities (Soto, et al., 2012).

Though this research has made much progress in improving our understanding of the effect of decentralization on the performance of the health care system, several gaps still remain. First, evidence on the impact of fiscal decentralization on health still is mixed, since there are also studies that did not find a link between decentralization and improvement of health performance (Martínez & Rodríguez-Zamora, 2011). Second, these studies also show that the effect of fiscal decentralization is contingent upon administrative and political decentralization. However, due to the almost exclusive focus on fiscal decentralization, little is known about the impact of administrative and political decentralization. Third, previous research neglected to answer the question under which conditions decentralization results in local health care system innovations, which is the key for improving overall health care performance (Bossert, 1998)

Research question

We define innovation as "the intentional introduction and application within a role, group, or organization, of ideas, process, product and procedures new to the relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society" (West, 1990). This definition extends the conceptualization of innovation as the application of new products, to innovation as the attempt to improve the performance of the health care system through new processes and structures. Product innovation is related to new types of service to a Community Health Centre's (CHC) stakeholders (such as services for aging people, specialist clinic). Process innovation refers to new delivery methods (e.g. payment procedures), and structure innovation relates to the creation of new internal and external infrastructures. Such innovations can occur both at the level of the district, and at the level of the organization (i.e. the primary health care centers).

Consequently, our main research question reads, "Under which conditions does decentralization of the Indonesian public health sector favor innovations at the district and organization (CHC) level?"

Social and scientific significance

Improving access to health care is one of the major challenges of any country's attempt to build a more sustainable society, and many observers consider persistent or even increasing socio-economic inequalities in health as one of the major threats for a country's social and economic development. However, policy makers still have to rely on very limited evidence on which to base their decisions. Decentralization provides them with the decision-space for more effective health care institutions. On the other

hand, the increased autonomy and discretion also confronts them with the problem of having to choose from a large set of potential interventions. For many of these possible interventions, little to no systematic information is available concerning the context conditions under which they might be effective and efficient, nor are the mechanisms through which they work well-understood (Fleuren, et al., 2004). The present study contributes to closing this gap.

Research methods and data

Indonesia's two waves of decentralization create the opportunity for a detailed comparative examination of how different institutional arrangements may affect health care innovation within the same socio-cultural context. Our analytical strategy, therefore, consists of two elements. First, we use the tools of comparative institutional analysis to map how key institutional dimensions in the health sector changed from the first to the second wave of decentralization. In order to identify these key dimensions, we build on the *Decision-space Approach* (DSA), a theoretical framework that was developed to analyze the effects of decentralization (Bossert T, 1998; Mitchel & Bossert, 2010; Bossert & Mitchell, 2011). Policy documents and administrative regulations are our major source for applying this framework to the Indonesian case. Second, given the paucity of health care innovations in the Indonesian system, we submit the few cases where innovation reportedly *did* occur upon scrutiny. In this case, analytic step, our strategy is to uncover possible commonalities in the conditions for and the pathways to innovation during both waves of decentralization. Our main data sources for this step are earlier case study descriptions and media accounts.

In what follows, we first give some background information on Indonesia's primary health care system and the main elements of decentralization. We then sketch our analytical framework, the Decision-space Approach, followed by sections on institutional analysis and case analysis. We conclude with a discussion of the innovation potential of the current Indonesian health care system.

Indonesia's primary health care system under decentralization

The Indonesian health care system was designed to implement the constitutional mandate to maintain and protect citizens' health status by providing accessible health care for all. Community Health Centers (CHC) are a major tool to achieve these outcomes. They provide primary health care that includes curative and preventive care, carry out information campaigns, and empower communities to play an active role in the health sector.

Within the local government structure, CHCs fall under the responsibility of the Department of Health (DoH), which also coordinates their activities. The DoH, in turn, reports their performance to the Ministry of Health (MoH). Local governments facilitate CHCs through allocating funds for health staff and facilities. Health staff may include physicians, midwives, nurses, pharmacists, nutritionist, public health practitioners, and administrative staff, while health facilities may include buildings, medical devices,

laboratories, ambulances, and pharmacies. Due to variations in local government policies and other local conditions, CHCs may differ considerably with regard to number and type of health staff and facilities.

CHCs are established at the sub-district (*Kecamatan*) level, based on a service coverage ranging between 10,000 to 30,000 inhabitants. CHCs may have auxiliary CHCs at the village level to enable them reach out the community in the villages. In areas with large distances to the nearest hospital, CHCs are equipped with a small number of beds (about 10) for in-patient care, and with motorized vehicles for visits in remote areas.

Two major reforms were carried out in the PHCS. During the first reform in 2004, the central government obliged local governments to provide health insurance for the poor (Law 40/2004 on the national social security system). Fiscal transfers from the central government flanked this measure. The law increased local governments' decision-space with regard to how to implement health policies. Also in 2004, a decree by the MoH granted CHCs with the authority to propose their own programs and budget allocation, based on the health needs of their community and the capacities of their CHC. Furthermore, every local government was required to allocate at least 5% of its total budget to the health sector.

The second reform started in 2014, when the central government changed the *out-of-pocket* payment system to the *universal coverage* system. In this system, all citizens with health problems first have to visit the CHC. In case the patient requires further medical care, the CHC will refer the patient to the appropriate hospital. The system is implemented by the Social Security Management Agency *(Badan Penyelenggara Jaminan Sosial),* which manages health insurance for all citizens (Law 24/2011).

Two waves of decentralization

Indonesia has implemented two waves of decentralization, the first wave started in 2000 and ended when the second wave started in 2004, the second wave continues up to present. In the following, we briefly describe them, focusing on their differences. The descriptions are based on the law on local governments (Law 22/1999 and Law 32/2004), the law on financial balance between central and local governments (Law 25/1999 and Law 33/2004), and government regulations on structuring local government organizations (PP 84/2000, PP 8/2003, PP 41/2007).

Political decentralization

In the first wave, elected members of the local council had the authority to elect and to impeach the mayor/governor and vice mayor/governor. There was an annual accountability report from the mayor to the local council. If the mayor's performance failed to satisfy the expectation of the local council, it could impeach the mayor. During the second wave, the local community directly elected the mayor and governors. Local councils had the authority to propose impeachment of the mayor/governor, but this

now required legal proof by the Supreme Court, confirming that the mayor/governors had violated the rules. The final decision concerning the impeachment was with the president. During both waves, the local council had the authority to approve or disapprove of local policy and regulations, including local strategic planning and budget allocations.

Administrative decentralization

During the first wave, the central government transferred all sectorial decision-space to the local governments. They now had the authority to establish and design new local government organizations, without any restrictions on number, size, and function. During the second wave, the possibility to establish new local government organizations was now limited by local revenue, population, the width of local jurisdiction, and other unique characteristics of a local government. The first wave enabled local governments to hire new employees on a contract basis, and promote and transfer employees between institutions in the local government. During the second wave however, the central government banned these practices in order to limit local government expenditures.

Fiscal decentralization

During the first wave, the law on financial balance allowed local governments to determine local taxes and levies to increase local revenue, without restrictions on the type and extent of these taxes. Central government amended the law on financial balance in the second wave that applied detailed restrictions on local taxes and complex anti-corruption procedure.

Theoretical background

Decision-space

Decision-space refers to "the range of effective choice that is allowed by the central authorities (the principal) to be utilized by local authorities (the agents)" (Bossert, 1998). For example, decision-space can vary to the degree that a district can determine its own health strategic planning, budgeting, human resources, and service/organization delivery. Within this decision-space, "local authorities may make innovative choices that are different from the choices they made before decentralization and different from directed change that the central authorities impose on localities which have not been decentralized" (Bossert, 1998). Decentralization increases the decision-space of lower level administrators, though the degree of decision-space that an administrator has can differ considerably across different sub-domains. In order to have an accurate picture of the decision-space, it is important to disentangle the various decision-making domains (e.g. finances, human resource management etc.) and their specific indicators.

Accountability pressure

Accountability refers to an agent's obligation to explicate and substantiate his or her conduct to principal or other stakeholders, who can raise queries and allocate sanctions (Black, 2008). Accountability mechanisms apply to the administrative, political, and fiscal domain, and ensure that decision makers are more responsive to local health needs. Decentralization tends to increase accountability of lower level administrators, where the Central Government pushes local governments to achieve specific health targets effectively, in order to improve health performance at the national level (Bossert & Mitchell, 2011). When assessing accountability pressures, one has to distinguish between two dimensions (Bossert & Mitchell, 2011): "accountability for what" refers to the different decision making domains and "accountability to whom" refers to the underlying hierarchical arrangement (Yilmaz, et al., 2008; World Bank, 2009). There are three categories included "accountability to whom". (1) Upward accountability implies that the decision maker has to report to upper level government organizations, e.g. a local government being accountable to central government. (2) Downward accountability involves situations in which the decision maker is responsible to a lower level entity, e.g. local government being accountable to the community. (3) Horizontal accountability refers to accountability to peer players, e.g. a local government being accountable to the local council (Bannink & Ossewaarde, 2012).

Organizational capacity

Organizational capacity relates to the question whether the resources and processes at the disposal of local administrators are sufficient to make and implement good decisions. Indicators of organizational capacity are organizational resources (e.g. adequacy of funds, infrastructure, and staff), and processes (e.g. evaluation, monitoring, and reporting to the national level), as well as human capital (e.g. individual training, education, and experience). Unlike accountability and decision-space – which are "externally" given – local decision makers have discretion to influence the capacity of their organizations. They are in a position to alter the structures, processes, products, and services of their organization in order to make it more effective and efficient (West, 1990; Varkey, et al., 2008; Omachonu & Einspruch, 2010). Such innovations have the potential to increase organizational capacity and improve its health care functions (Omachonu & Einspruch, 2010; Varkey, et al., 2008). Hence, in line with earlier applications of the Decision-space Approach (Bossert, 1998), we consider product, process, and structural innovations as an important correlate of organizational capacity (Greenhalgh, et al., 2004).

Analytical framework: the decision-space approach

The link between decentralization and performance of the health sector refers to macro-level phenomena. Following the social mechanism logic as advocated by Analytical Sociology (Hedstrom & Udehn, 2009; Coleman, 1986), we use a theory of action that explicates the mechanisms linking the macro-level of societal phenomena with the micro-level of individual decisions and actions (see figure 2-1) the Decision-

space Approach (DSA). This approach draws on principal agent reasoning. It argues that decentralization changes the degree of decision-space, accountability, and organizational capacity that decision makers have in order to develop effective innovations. The micro-level actions aggregate to macro-level outcomes. Our study focuses on the micro-level, specifying the interplay between the decision-space, accountability, and organizational capacity and their impact on local health care innovations.

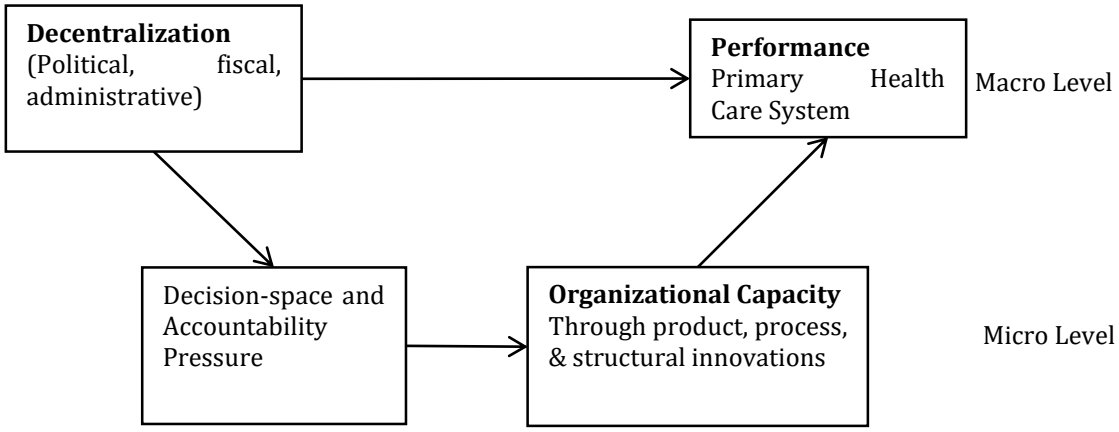

Figure 2-1 Conceptual Model

The Decision-space approach (DSA) is one of the few general analytical frameworks explicating how decentralization affects policy outcomes through changing preferences and constraints of local decision makers. It proposes that decentralization has the potential to improve health care outcomes. The idea is that decentralization bestows more decision-space to local decision makers, allowing them to be more responsive to local conditions and community health needs (Bossert, 1998). However, decision-space alone will not suffice unless complemented by appropriate accountability mechanisms (Mitchell & Bossert, 2010) and the organizational capacity to implement decisions (Bossert & Mitchell, 2011). Decision-space and accountability requirements are exogenously given institutional boundary conditions within which local level decision makers need to operate. The dimension on which they can exert some influence is the capacity of their organization. Organizations that succeed to increase their capacity have a higher chance to be more effective and efficient. We argue that a significant increase of a CHC's capacity requires some degree of product, process, and structural innovation. Hence, the core question becomes to what degree the changes in decision-space and accountability favored or inhibited innovative expansion of organizational capacity.

Decentralization and health system innovation in Indonesia: institutional analysis

In this section, we analyze to what degree decision-space and accountability, the two most important institutional boundary conditions for health care innovations, differed between the two waves of decentralization.

Decision-space

Building on previous applications of DSA to health care innovation (Bossert, 1998; Mitchell & Bossert, 2010; Bossert & Mitchell, 2011), we distinguish five major decision-space categories. Within each of these categories, we used, where possible, the indicators that also previous studies had applied. Where necessary, we adapted them to the specific context of CHCs in Indonesia (for a definition of each of these indicators, as follows, see also Table 2-1): 1) Strategic planning; 2) Service organization (required programs, hospital autonomy, insurance plans, procurement of goods); 3) Human resources (contracting, civil service); 4) Financial management (expenditures, sources of revenue); 5) Governance rules (structure and design of facility boards, district offices, and community participation).

For each indicator and for both waves of decentralization, we determine whether the decision-space is narrow, moderate, or wide. The decision-space with regard to a specific indicator is narrow if the organization or district has no discretion, because the decision-making authority rests entirely at the upper level. The decision-space is wide if the local government faces (almost) no restrictions that would constrain the range of alternatives. The decision-space is moderate if the local government or organization faces restrictions, but also has some autonomy in taking decisions.

One indicator measured decision-space with regard to *strategic planning.* Decision-space was wide during the first wave, because the law permitted local governments to formulate the strategic planning themselves, and did not impose further constraints. During the second wave, a government regulation added restrictions. It mandated that the strategic planning in local government had to be in line with the strategic planning at the national level. Since local governments still had the discretion to determine their own strategic planning, we classify the decision-space during the second wave as moderate.

In the domain of *service organization*, for three out of four indicators, decision-space was wide during the first wave, but dropped to moderate during the second wave. Local governments faced no constraints with regard to *programming* and the *insurance plans* they wanted to implement; moreover, the central government's requirements concerning standardization of *procurement* were very loose. During the second wave, decision-space on these three dimensions of the service organization decreased to moderate, because central government narrowed down the range of options from which local governments could choose. We observe the reverse pattern for one of the indicators, CHC autonomy, however. Here, decision-space was narrow during the first

wave, when CHCs had a uniform structure and functions, determined by the central government. Decision-space on this dimension increased to wide during the second wave, when these restrictions were eliminated.

Table 2-1Description of Decision-space Domains

Decentralization Types	Decision-Space Domains	Description
Fiscal	Expenditures	Ability to determine budgetary allocations (including planning, budgeting, and execution)
	Revenues	Authority to use funds raised from all levels of the system (including intergovernmental transfers, own-source revenues, income from user fees and contracts, borrowing)
Political	Strategic Planning	Ability to accommodate local community health needs into health policy and program at the local level that differs from policy and programs of the central government
Administrative	**Service Organization** Required programs	Ability to modify implementation of national programs
	Health Centre autonomy	Ability of health centers to be independently managed (including discretion over all health sector functions within health centers)
	Insurance plans	Ability to create, manage, and or replicate local insurance mechanisms (for example determine service coverage/minimum packages; introduce community based health insurance)
	Procurements of goods	Ability to procure goods and services
	Human Resource Management Civil service	Ability to decide over compensation packages (for example, basic salaries, allowances); determine terms of employment (for example, including recruitment, appointment, transfer, promotion and termination)
	Contracting	Authority to define the range of permissible contracting options
	The health department	The ability to structure and design the function of the health department
	The health centres	The ability to structure and design the function of health centers

Source: adapted from (Bossert T. , 1998; Mitchel & Bossert, 2010; Bossert & Mitchell, 2011)

Two indicators measure decision-space with regard to *human resources*. First, *civil service* represents the ability of local governments to determine compensation packages, like salaries and allowances, terms of employment, recruitment, appointment, transfer, promotion, and termination of employment contracts. Second, *contracting* represents the range of permissible contracting options. For *civil service*,

decision-space was narrow during the first wave, because the local government had to implement the compensation package regulations of the central government. During the second wave, the decision-space grew to moderate when local governments were granted the right to introduce performance related incentives. We observe a reverse pattern for the second indicator, contracting of employees, however. Decision-space was moderate during the first wave, but it decreased to narrow during the second phase in 2005 when the central government completely banned contracting employees, in order to limit the growing number of civil servants.

With regard to *fiscal management*, local governments' decision-space declined from wide to moderate on indicators, *revenues* and *expenditures*. During the first phase, local governments faced no restrictions concerning the amount of local taxes and their allocation. On the contrary, during the second phase, the central government imposed rigid regulations concerning the type of taxes that could be levied, and it defined a minimum amount that had to be allocated to the health sector.

Finally, two indicators measure decision-space with regard to *governance rules.* Decision-space to design the *structure of the health department* was wide in the first wave while moderate in the second wave, because the central government standardized the number and size of local government organizations. We observe the opposite pattern with regard to the decision-space to design the *structure of the CHC,* which was narrow during the first wave, but wide during the second wave, when previous restrictions concerning the structure and function of local CHCs were removed.

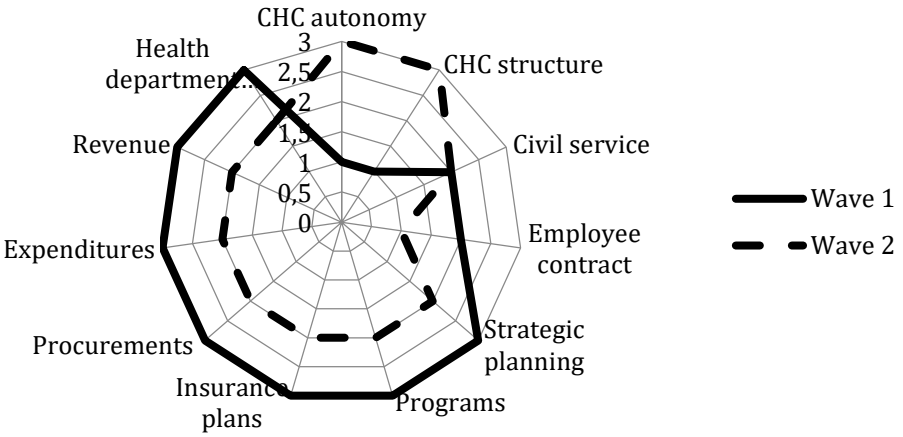

Figure 2-2 Changes in Decision-space from the first to the second wave

Figure 2-2 summarizes the patterns for all eleven indicators. Overall, we observe that from the first to the second wave, decision-space declined in eight of the eleven domains. In all but one of the cases, the change involved the introduction of some

restrictions in a situation in which local decision makers had very little constraints (wide decision-space). In two domains, decision-space increased, and considerably so autonomy and structure of the CHC augmented from "narrow" to "wide". In sum, the second wave of decentralization resulted in a reduction of decision-space compared to the first wave

Accountability pressure

Previous studies suggest a link between innovation and the type and degree of accountability pressures that decision makers face (Fleuren, et al., 2004; Lansisalmi, et al., 2006; Varkey, et al., 2008). For the Indonesian context, we distinguish between high, medium, and low accountability pressures based on three types of underlying hierarchical arrangements.

First, most local governments still depend on the upper level of government for a major part of their funding. Given this dependence and central government's opportunities to reinforce and sanction (Fleuren, et al., 2004), we consider arrangements containing upward accountability as involving the highest level of accountability pressure.

Second, due to political decentralization, local decisions makers also have political motives. Local government officials have an interest in maintaining their electorate (Lansisalmi, et al., 2006), and for CHC leaders to stay in function, their CHCs need to meet high performance demands from their local communities (Varkey, et al., 2008). Hence, downward accountability requirements – from local government to the community – can still create quite some pressure. We classify the presence of downward accountability requirement as medium accountability pressure, because for the involved decision makers, the potential consequences of non-compliance (e.g. in terms of direct sanctions) are less immediate than compared to upward accountability.

Finally, horizontal accountability involves interaction between the mayor and the local council. It usually applies in contexts where regulations have to be drafted (Fleuren, et al., 2004). Compared to upward and downward accountability requirements, we consider horizontal accountability arrangements as exerting the least accountability pressure.

Note that a specific decision domain can be subject to multiple accountability arrangements at the same time. In many cases, a decision maker is accountable to both higher and lower levels. We assume that in such cases, accountability pressures add up, since it implies an increase in the number of stakeholders to which the decision maker has to report. Therefore, for the purposes of our analysis, we attach numerical weights to the three types of accountability arrangements, with the highest score "3" for upward accountability, an intermediate score "2" for downward accountability, and the lowest score "1" for horizontal accountability. Consequently, the maximum score for accountability pressure in a decision making domain is "6", representing a situation in which a decision maker is upwardly, downwardly, and horizontally accountable. The lowest score is "1", representing a situation in which the decision maker is only

horizontally accountable. In what follows, we assess (changes in) accountability pressures in the eleven decision-making domains as they were discussed in the previous section.

First, with regard to *strategic planning,* accountability pressure during the first wave was restricted to the local council scrutinizing the local executive body; it was based on horizontal accountability only, resulting in the lowest score ("1") on our accountability pressure scale. Accountability pressures increased drastically during the second wave, when both upward and downward pressures flanked horizontal accountability requirements. First, a law on public information now obliged local government to publish their strategic planning on the official website. Furthermore, since the introduction of direct elections, local communities now paid special attention to what degree elected officials indeed had kept the promises they made during their election campaigns (downward accountability). Second, a new law now required central and local government to share authority on strategic planning. This significantly increased the central government's influence on and control over the strategic planning process of local governments. With all three types of accountability arrangements in place, the accountability pressure during the second wave cumulates to the highest score on our scale ("6").

Second, we observe an increase in accountability pressure also in the domain of *service organization.* This is due to the fact that all indicators in this domain, upward accountability in the form of tighter standardization and regulations guiding implementation, were added during the second wave. *Required programs* increased (from "4" to "6") because the second wave added downward accountability - citizens being able to exert pressure on local governments to realize the programs promised during their electoral campaigns - to the upward and horizontal accountability established during the first wave. During the second wave, accountability pressure on CHCs grew (from "3" to "5"), resulting in lower *CHC autonomy*: CHCs receive funding from the MoH and implement central government programs. Furthermore, accountability pressures concerning the *procurement of goods* increased (from "4" to "6"), since during the second wave, the procurement procedure requires local governments to publicly announce each step on their website, thereby adding downward accountability requirements to the upward and horizontal accountability pressure in place since the first wave. Accountability concerning *insurance plans* also increased (from "1" to "4"). While the first wave involved only horizontal arrangement, the second wave added both horizontal and upward arrangement, since central government obliged local government to provide health insurance for the poor.

Third, both indicators in the field of *human resources* reflect increasing accountability pressures. During the second wave, local governments lost the authorization to *contract* health staff, which now restricted by the central government. The same holds for the right to manage the civil service. In both cases, accountability pressure rose from only horizontal accountability (score "1"), to both horizontal and upward accountability ("4").

Fourth, in the domain of *financial management,* we observe an increase in accountability pressure with regard to the approval of the budget planning, *expenditures* and *revenue.* During the first wave, it involved upward and horizontal accountability arrangements (score "4"), while in the second wave it involved upward, downward, and horizontal accountability (score "6"). Local governments are currently required to announce their budget of expenditures and revenue to the community by uploading this information on the official website of the local government, enabling the local community to scrutinize the financial management.

Finally, accountability pressure also increased in the domain of *governance rules*, with control over the *structure of CHCs* and the *structure of the Health Departments* switching back from horizontal accountability in the first wave (score "1"), to upward accountability towards the central government in the second wave (score "3").

Overall, we see a notable increase in accountability pressure from the first to the second wave of decentralization in nine of the eleven indicators (see Figure 2.3). Since the second wave, the highest pressure rests on strategic planning, required programs, expenditure, and CHC autonomy. Only in one case, insurance plans, did the accountability pressures decline to the minimal level (horizontal accountability).

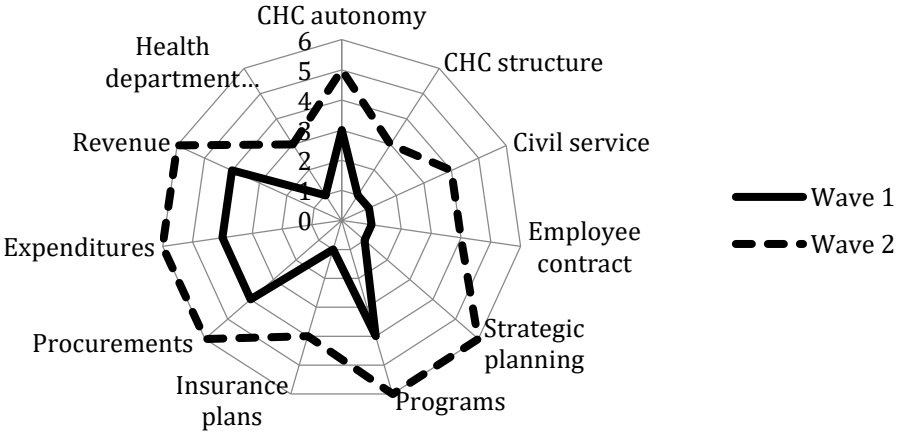

Figure 2-3 Changes in Accountability Pressure from the first to the second wave

Institutional analysis: summary and conclusions

The Decision-space Analysis has allowed us to decompose the institutional frameworks governing the health sector during the two waves of decentralization into its two major operational dimensions: the degree of discretion (or decision-space), and the degree of accountability that local level decision makers face. Our analysis yields three main insights.

First, the two institutional frameworks of decentralization differ significantly from each other. In fact, we observe a double movement, taking place from the first to the second wave. It consists of an overall reduction of decision-space, combined with an overall increase in accountability pressure.

Second, there is one notable exception to the reduction of decision-space, and this is related to the autonomy and structure of the CHCs; here, the trend is reversed: maximum discretion is transferred to local decision makers.

Third, our analysis reveals that compared to the indicators for political and administrative decentralization, the two indicators measuring fiscal decentralization (expenditures and revenues) show a relatively smaller degree of change, both with regard to accountability pressures and decision-space. This is particularly noteworthy given the strong and almost exclusive focus on fiscal decentralization that had dominated research up until now. The major adjustments took place in the domains of political and administrative decentralization, and they may be among the more prominent opportunity structures for improving the capacity of health care organizations through product, process, and structural innovation. This is what we turn to in the next section.

Decentralization and health system innovation in Indonesia: case analysis

The previous section demonstrated that the institutional conditions for improving organizational capacity through health care innovation changed from the first to the second wave of decentralization. During the first wave, local level decision makers had little room and incentive to execute innovations, and while district level players had the discretion, a weak accountability system apparently kept them from investing and instigating innovation. Conditions for local level players changed during the second wave, with accountability pressures mounting and discretion decreasing in some domains, but increasing in others - most notably with regard to autonomy and structure of the CHC.

Given these changes in the institutional contexts, two questions arose. First, how was it possible that some districts and CHCs succeeded in realizing exemplary innovations, despite the problematic institutional context? Second, are there some general patterns that these successful innovation cases share?

In this section, we attempt to give some tentative answers to these questions by examining some well-documented cases of health care innovation in Indonesia. The purpose of our case analytic approach is to gain deeper and a more detailed insight into the social, political, and economic context and processes behind the innovations. More specifically, we are interested in the kind of innovations that were realized, their antecedents, how they relate to the changes in decision-space and accountability pressures, and their outcomes in terms of enhancing organizational health care capacity and performance.

With the exception of one well-known district level case (Jembrana), there is relatively little documentation on health care innovations in Indonesia during the first wave of decentralization. There is some reason to assume that this lack of information reflects the paucity of actual innovation attempts during this period. The situation, however, changes during the second wave. We assume that this reflects increased decision-space to design the programs and define the budget, as it was granted to CHCS at the start of the second wave decentralization (2004).

Table 2-2 District level health care innovation cases - summary overview

		Case 1: Jembrana	Case 2: Surakarta, Jakarta, Bandung, Kulon, Progo, Manado	Case 3: Pemalang
Background	Period	Initiated 2001, implemented 2003, still ongoing		Initiated in 2004, terminated in 2005
	Trigger	Initiated by the Mayor	Central government policy on national social security; Fiscal transfer to partly finance the insurance	National health vision to decrease the infant and maternal mortality rates
	Enabling Conditions	Commitment from the Mayor & Efficiency	Availability of successful template (Jembrana) for replication; Mayor's Commitment & Creativity to design the method and finance the uncovered insurance by fiscal transfer	Mayor's commitment
	Methods	Bureaucracy reform; Downsizing; Cooperation with private hospitals and clinics	Minimum health budget at least 5% for each local government	Continuation of foreign aid project
Innovation	Product	Universal coverage system	Health insurance for targeted people	Midwife voucher
	Process	Different process for financing primary health care	Reimbursement or direct subsidy	Reimbursement
	Structure	New local government institution function to provide the health insurance	New institution to manage health insurance	-
Outcomes	Capacity	Increase the quality of health facilities; Increase the accessibility of health care for all	Increase the accessibility of health care for all	Increase the number of midwives
	Performance	-	-	Increase the accessibility of midwife service

For our case analysis, we draw on two studies investigating innovation at CHC-level (Anggraeny, 2013; Rachmawati & Suprapto, Agus, 2010), and on an official blog that describes innovation at the CHC of Mojoagung. The report by the Ministry of Administrative Reform the Republic of Indonesia provides too little detail for our purposes.

We present six short vignettes on innovations that significantly improved organizational health care capacity. Three of them cover the district level (for a summary overview, see Table 2-2), and three cover the CHC level (see Table 2-3). With the exception of the Jembrana case at district level, all of the cases emerged during the second phase of decentralization (i.e. after 2004). For each case, we first sketch the type of realized innovation and how it affected organizational capacity. We then explore its potential antecedents.

Table 2-3 Community Health Centre innovation cases - summary overview

		Case 4: Jagir	Case 5: Mojoagung	Case 6: East Java
Background	Period			
	Trigger	Initiated by head of CHC	Initiation of the CHC's manager	Triggered by national health vision related to MDGs
	Enabling Conditions	Concern to the condition of old technology application	Skill to recognize the health problems and potential contribution from external actors	Commitment of the Mayor
	Methods	Finance reallocation to medical devices	Partnership with the PERTAMINA "national oil enterprise"; Partnership with university and community	Involve public participation as health care volunteer; Increase the number of health staff and distribute them more evenly
Innovation	Product	Health service for the aging people, specialists, and teenagers	Cataract surgery and care post-surgery	24 hours prenatal and maternal care
	Process	The use of new technology for diagnoses	-	-
	Structure	New clinics	-	Increase number of PODES
Outcomes	Capacity	The increase of health care quality and quantity of health staffs	-	Increasing number of midwives and trained traditional midwives
	Performance	The increase of health care process quality	Solve the problem of poor patients with cataract; Solve the problem of worm diseases	More accessible natal care

District level innovations

Universal health insurance coverage (Jembrana)

Health care innovations during the first wave of decentralization were very rare. This makes the Jembrana case particularly interesting. This case is quite well known at national level (Komisi Pemberantasan Korupsi , 2008; Trisnantoro, et al., 2012). Organizations at the central government level, ministries, NGOs, high-level officials from other districts, and researchers visited Jembrana to learn from the practice. Jembrana acquired national fame because it was the first district to abolish the *out-of-pocket system* in favor of a *universal coverage health insurance (Jaminan Kesehatan Jembrana* (JKJ)). This product innovation was initiated in 2001, implemented in 2003, and is currently still active. Additional innovations accompanied this program, for example a *process innovation* that consisted of a new system for financing primary health care.

The creation of a new local government organization, *Badan Penyelenggara JKJ* or *Bapel,* to administer health insurance was a major *structural innovation*. It has a key role in the implementation of JKJ. It applies tight standardization procedures and strict verification of claims, in order to assure that the funds for medication reach those citizens who are indeed entitled to them. Each month *Bapel* processes thousands of individual insurance claims. It handles registration and re-registration of thousands of members, and it manages the payment of claims and the contracts between the local government and other health institutions, such as community health centres, public and private clinics, and hospitals.

Together, the product, process, and structural innovations have resulted in a significant improvement of CHC capacity, and have improved accessibility of other health facilities like public and private hospitals and private clinics participating in JKJ (World Bank, 2006). These measures increased health access for the poor, and resulted in higher levels of patient satisfaction. Furthermore, the capacity of PHC facilities has improved: CHC buildings were enlarged and laboratories and in-patient facilities were created.

Next, we ask, how were these innovations implemented, and which conditions made this possible? Implementing the JKJ conveyed many challenges. One of the major obstacles certainly was the relative lack of funds, particularly if compared to other districts in the Island of Bali. Therefore, Mayor Winasa, a medical professional, university professor and dentist, used two main strategies to implement health system reforms.

First, he downsized and restructured local governments, reducing the number of district organizations from 24 to 17. This yielded an annual savings of Rp. 2-3 billion (US$ 200-300,000). The mayor used these savings to finance the health reform (World Bank, 2006).

Second, he initiated an administrative reform by stipulating regulations on civil servants disciplines and incentives; procurement system that enables retrenchment in government spending; and the use of information technology to enhance the transparency and connections between parts of the system in local government to prevent JKJ abuse (World Bank, 2006; Komisi Pemberantasan Korupsi , 2008; Trisnantoro, et al., 2012).

The increase of decision-space in the wake of the first wave of decentralization provided the necessary discretion for the interventions. With wide authority to determine the strategic planning, Jembrana used the opportunity to formulate its own strategic plans, which differed from those in the national health system. In the domain of service organization, Jembrana freely defined its new insurance plan, literally reinvented its health facilities, and restructured its buildings. It also loosened the rigid standards that regulated procurement procedures of in-patient facilities. Furthermore, new human resource policies were introduced. Civil servants were now rewarded according to their performance, and Jembrana invested in the recruitment of well-trained health professionals to staff the new *Bapel* organization and other health organizations. Finally, Jembrana also modified some of its governance rules, in particular with regard to the new local health insurance managed by *Bapel*. These rules facilitated both contract agreement with health care providers, and the verification of health care claims, thereby preventing fraud by health care providers.

All these changes were possible because the first wave of decentralization abolished many of the rigid standards of central government. However, this increase in decision-space also applied to all other districts in Indonesia, of which the vast majority did not embark on any innovation trajectory to expand their organizational capacities.

What made Jembrana special? In addition to the mayor's initiative and creativity in shaping new programs and freeing the necessary funds, networking was a major enabling condition behind the success of Jembrana's initiative (World Bank, 2006; Trisnantoro, et al., 2012). The mayor successfully activated and managed collaborative networks with professionals and local councils, like the director of the district hospital, the managers of CHCs, and the managers of *Bapel*. He successfully lobbied the local council to approve his programs, and succeeded in motivating the civil servants to implement the reform.

Though the JKJ faced severe challenges, it proved to be sustainable. However, it was only during the second wave of decentralization that other districts started to emulate Jembrana's model, and now, universal health insurance coverage has become part of the national health system.

Health insurance (several districts)

With the second wave of decentralization, while the decision-space partially declined, the accountability pressures went up across the board. Based on the law on the National Social Security System, enacted in 2004, the MoH launched a program for health insurance for the poor in 2007. According to the decree, every district has the authority

to design and implement health insurance for the communities in its area, and can build on fiscal transfers from central government for this purpose – but every district was obliged to implement this policy. This change may be one of the reasons why we observe an increase in health care innovations also in other districts, several of which started to adapt Jembrana's health insurance model for their purposes. For example, Surakarta-Central Java and Jakarta introduced health insurance for the poor, and Badung-Bali introduced a 24 hours service. In 2011, the Province of Bali introduced health insurance for the wider community (Based on Governor Decree delivered in 2008). Other local governments developed innovative health insurance not only for the poor but also for all citizens, such as the city of Makassar (Dwicaksono, et al., 2012), *Manado* (Ministry of Administrative Reform the Republic of Indonesia, 2014), and the district of *Kulonprogo* (Ministry of Administrative Reform the Republic of Indonesia, 2014).

Midwife coupon service (Pemalang)

In 2004, the district of Pemalang introduced a midwife coupon service. Here, midwifes – who can be civil servants or operate as individual entrepreneurs – are paid based on how many coupons they collect. The service started as a pilot project that was initiated by central government with funds from a World Bank loan. Its aim was to encourage women from poor households to visit midwifes during pregnancy and for the delivery. The program was successful since it increased the number and, in result, the availability of midwifes, thereby considerably improving organizational capacity. However, for unclear reasons, the program was terminated by central government, in the midst of its implementation. Nevertheless, Pemalang continued this program, using its local government budget, but ended it in 2005, because it overlapped with the Health Insurance for Poor program.

The Pemalang case is interesting because it reflects an innovation that started as an initiative from central government, rather than growing out of the district itself. However, as in the Jembrana case, its continuation is mainly due to the mayor's commitment and success in reallocating local funds for this project.

Community Health Centre innovations

New technology and new services (Jagir)

Process innovation at the community health center of Jagir (Surabaya city, East Java), took the form of implementing new technologies for diagnosis, like computer ultrasonography (USG), a complete and state-of-the art dental unit, and a photometer (Anggraeny, 2013). The initiative for scaling up medical technology came from the head of the CHC, who was concerned about the outdated material in the center. In order to be able to purchase better and more modern equipment, he decided to reallocate funds for this purpose. CHC of Jagir also introduced a variety of *product innovations* in the form of new services. (1) Specialist practices, e.g. for dermatology and venereal

diseases, gynecology, or degenerative diseases, hypertension, diabetes mellitus, and cancer; (2) extension of opening hours; (3) teenage counselling by professional psychologists; (4) a "neighborhoods program" in which communities receive coaching related to disease prevention and handling health problems in their community, and; (5) in-patient care.

Finally, *structural innovations* consisted of the creation of new clinics providing special care for the elderly. The clinics also contain a unit for health services and are active in the field of health promotion.

Partnership and collaboration (Mojoagung)

In 2012, the CHC of Mojoagung received the MoH award for Best Performing Health Institution for its activities in the field of health promotion and disease prevention. This CHC had implemented two kinds of *product innovations* (http//puskesmasmojoagung.wordpress.com). First, it offered cataract surgery and free after-surgery treatment. This initiative represented an annual social responsibility activity and funded by PERTAMINA State's Oil Enterprise. Second, a program to fight endemic worm disease was introduced.

As in the Jagir case, the initiative for this innovation came from the head of the CHC, who was puzzled by the high incidence of worm disease in the community. He took a soil sample and brought it to the nearby university laboratory. The results showed that the soil was contaminated with cow waste. To solve this problem, he initiated a program to install biogas energy based on cow waste that uses the cow waste as the material to produce electricity. The use of the biogas installation prevented the soil contamination that caused worm disease. This project was realized in the context of a partnership program with Airlangga University in Surabaya. It also could build on strong participation by the local community, whose members collectively were willing to buy installation material and to learn how to maintain it. In turn, the university agreed to set up the biogas installation for free.

Obstetric and neonatal emergency service innovation, PONED (several CHCs in East Java)

In 2004, the Ministry of Health (MoH) initiated a program providing basic obstetric and neonatal emergency services (PONED). A study (Rachmawati & Suprapto, Agus, 2010) of three districts in the Province of East Java (Jombang, Ngawi, and Sampang) provides detailed insights into its implementation, outcomes, and success factors.

The purpose of this program was to reduce infant and maternal mortality rates. The main tool to achieve this objective was a *structural innovation*, consisting of the creation of new health posts (*PONED)* in villages. PONEDs were separate administrative entities, and its health staff did not overlap with CHC staff. As a result, this innovation could only be implemented in regions where CHCs already had sufficient health staff. This was flanked by investments from the government, who offered health staff for delivery and infant care, and to train medics, midwives, traditional midwifes, and

nurses, all of whom had to be on standby for 24 hours, 7 days a week. This *product innovation* significantly increased organizational capacity, allowing delivering 24-hour prenatal and maternal care.

Active community participation during all phases (planning, construction, and running of *PONED*) was an integral element of the program. Two measures in particular were important for its success. First, through empowering village midwifes, effective cooperation and interaction between the community and *PONED* became possible. Second, professional marketing teams increased community awareness through information campaigns about *PONED*, encouraging community members to make use of its services.

Case analysis: summary and conclusions

The case vignettes presented above are neither exhaustive nor representative for health care innovation in Indonesia. Nevertheless, these examples shed some more light on *how* the changes in decision-space and accountability pressures might have affected a health organization's inclination to initiate capacity-enhancing innovations. We see two noteworthy patterns.

First, it seems that the surprising lack of innovation during the first phase is due to a very unfortunate combination of circumstances. Despite the fact that decision-space increased in most domains, compared to the centralization era, it remained restricted in two crucial areas: CHCs had very limited autonomy to determine both their own structure and their own functions. In combination very low accountability pressures, this institutional structure impeded serious innovation attempts: the system relied on horizontal accountability only. With the mayor depending on the local council, community interests became less salient in shaping local health policies. The Jembrana case is a noteworthy exception and a case in point: its success is largely due to the mayor's strong commitment, professional background, and personal networks, which allowed him to overcome these obstacles. During the second wave, when accountability pressures increased but CHCs also were granted more autonomy, capacity-enhancing innovations started to proliferate at the CHC level as well, and they indeed showed quite some variation. The case material suggests that the institutional arrangements during the second wave of decentralization created favorable conditions for capacity-enhancing innovations at the level of CHCs. With the CHC in many domains now also being accountable to the local community, it has a stronger incentive to use its autonomy to adapt to the local health needs. Each CHC may face a variety of health problems, which also require different solutions. This also holds for national level programs like PONEDs, since it is built on participative structures that allow local governments effectively adjusting to local conditions.

Second, the mobilization of additional resources has been a major enabling condition for most local governments. Adequate *funding*, or lack thereof, though important, is only one element in this context. During the first wave of decentralization, about half of all local governments spent more than 60% of their budget to pay for the salary of civil servants. During the second wave, the central government alleviated the

problem through fiscal transfers, and the requirement to allocate at least 5% of local government budgets to the health sector. Nevertheless, in several of the cases, re-allocation of internal funds towards the new initiatives was a major precondition for launching innovations. This usually required some massive internal restructuring, a process that not every CHC management may be willing or able to launch. Enlisting the *support of external stakeholders* (e.g. in the form of sharing expertise or providing subsidies) also proved to be crucial, as the Mojoagung case shows. In those cases, where CHCs managed to secure outside support, their leaders either could draw on extensive personal networks, or had the social skills to cultivate them.

Conclusion

There are many factors affecting organizational innovations in the health sector (Fleuren, et al., 2004). Our study, which focused on some of the institutional conditions that may facilitate or impede such innovations, allows for some general tentative observations.

First, the Decision-space Approach proved to be particularly useful to map the changes in the institutional contexts, because it allowed disentangling key decision and accountability domains. Our institutional analysis showed that arrangements during the first and the second wave of decentralization differ considerably, and that there is quite some variation in decision-space and accountability across different domains during each phase. Whereas during the first phase decision-space was wide across most domains, autonomy of CHCs remained very low, creating a major stumbling block for capacity enhancing innovations. Since the second wave of decentralization, the institutional framework increased accountability pressures in combination with more decision autonomy with regard to CHC structure and function, but somewhat lower decision-space in the remaining domains. This combination seems to be favorable for capacity-enhancing innovations at CHC-level.

Second, our case analysis revealed that successful innovation initiatives were often built on the presence and cultivation of cooperative social networks, both with external and internal stakeholders. In the upper echelons, personal connections facilitated lobbying key decision makers in the system. Lower down in the hierarchy, social networks of CHC management, health staff and community members contributed to build the trust and commitment that was necessary for carrying out the sometimes major restructurings required to implement an innovation. Since these networking capacities most likely differ considerably across CHCs, they may be one of the possible conditions explaining variation in their innovation potential.

Future research may benefit from our study in at least two ways. First, we found that increased organizational efficiency is one key ingredient of successful capacity-enhancing innovation. However, efficiency itself may be part of daily decision-space use in providing health service, particularly for health care service providers like

CHCs. Hence, an in-depth study on decision-making processes at CHC level may be a fruitful endeavor.

Second, our case studies showed the crucial role of mobilizing external stakeholders to contribute to health care provision. However, little is known about how management and employees of CHCs manage to activate sustainable collaborative networks that serve in improving organizational capacity.

To conclude, in the year 2015, Indonesia counted 548 local governments (Ministry of Home Affairs' Decree, 39/2015), and approximately 9,815 community health centers. The degree to which they will be able to deliver effective health care in the future will strongly depend on their ability to adapt successfully to local circumstances. Finding innovative methods to improve their organizational capacity will remain a crucial element to achieve this objective.

THREE

Community Health Center Efficiency, Organization Design and Context[2]

Abstract

Since decentralization of the Indonesian health care system in 2000, decision makers at the level of both district and local community health centers (CHCs) have the freedom to tailor the services of their organizations to the particular needs of their clients. Many observers see this as an opportunity to achieve higher productivity in CHCs because they now have the autonomy to tailor their services and organization to their specific working context. This study assesses the efficiency of Indonesian CHCs after ten years of decentralization (2011). Data envelopment analysis is used to estimate the efficiency differences between 598 CHCs, for which information could be compiled and coded from two archival sources. Hypotheses explaining variations in efficiency are derived from the context-design-performance framework, and empirically tested using censored Tobit regression analyses. First, CHCs with less mixed staff show higher efficiency levels. Second, the number of horizontal units affects CHC efficiency only in non-remote areas, and the effect has an inverted U shape: efficiency is best for CHCs with 1-2 horizontal units and decreases for CHCs exceeding or not reaching this number. Third, the proportion of poor people in a CHC's service coverage area has no direct impact on efficiency but slightly tempers the effect of the number of horizontal units.

Keywords: Efficiency, community health centers, context-design performance framework, contingency theory, Indonesia

[2] This chapter is co-authored with Rafael Wittek, Bart Los, and Liesbet Heyse.

Introduction

Community health centers (CHCs) are frontline operational organizations in national primary health care systems that have the task to effectively and efficiently provide equal, accessible and affordable health care to local communities. (Starfield, Shi, & Macinko, 2005; Kringos D. , Boerma, Hutchinson, Zee, & Groenewegen, 2010; Starfield, 2012; Groenewegen, Heinemann, Greß, & Schäfer, 2015) Many countries invest in improving CHC capacity in order to provide responsive health care that meets the needs of the communities these centers serve (Marathe, et al., 2007; Pelone, et al., 2015).

In Indonesia CHCs also have a prominent role, especially after the decentralization wave that began in 2000 in many policy domains including health care. The decentralization effort in health care had three components. First was the fiscal transfer of the health budget from central government to local governments in 2004 (Heywood & Harahap, 2009). Second, in the same year, local authorities granted CHCs autonomy to decide on the strategy, functions and organization design of their centers, thereby allowing variation between CHCs within and across regions. (Miharti, Holzhacker, & Wittek, 2016). Third, the government introduced health insurance for the poor in 2006 (Sparrow, et al., 2016). This transfer of resources and authority to local governments and CHCs was balanced by a mechanism of multi-layered decision-space in which the Ministry of Health retained some influence by defining minimum standards regarding the functions, organization design, and performance of CHCs (Miharti, Holzhacker, & Wittek, 2016).

The increased decision-space of CHCs gives them the freedom to decide how to use their resources best to respond effectively to local community health needs and conditions. It also allows them to experiment with innovative solutions (Bossert, 1998) to achieve maximum health outputs with their available resources. If CHCs use their decision-space wisely, this is expected to lead to higher productivity in health care provision across regions, because CHCs can now adapt their strategy, design, and functions to the context of their service coverage area (Bossert, 1998; Mitchell & Bossert, 2010; Bossert & Mitchell, 2011).

The aim of this paper is to study the distribution of efficiency levels of CHCs in Indonesia. Building on the context-design-performance (CDP) framework developed for the health sector (Marathe, et al., 2007; Ortiz, et al., 2010), we aim to answer the following question: What variation is there in CHC efficiency in Indonesia's decentralized health care system, and if so, how can it be explained?

We argue that CDP-related factors, such as differences in CHC organization design and context, explain the variation in CHC efficiency because the increased decision-space might not be used wisely or cannot be used fully to improve productivity. In other words, CHCs may make more and less optimal design and service-provision choices. This paper aims to identify these erratic design choices by studying if and how organizational design factors and organizational context characteristics, separately and combined, contribute to CHC efficiency.

This study makes three contributions to the literature. First, it furthers insights into the efficiency of CHCs in the context of enlarged decision-space in the Indonesian health care sector and beyond that context by studying CHC efficiency and variation in efficiency between CHCs. Second, this is one of the first empirical studies to put the CDP framework to a systematic statistical test in a large sample of CHCs. Previous studies on Indonesian CHC efficiency were more exploratory in nature and covered CHCs in a particular district (Berman, 1989; Budi, 2010; Supiati, 2014; Setyaningrum & Woyanti, 2015). This study extends this research with a systematic comparison of CHC efficiency and their determinants across districts. Finally, this study may inform policy makers and managers of primary health care organizations about the determinants of CHC efficiency.

The chapter proceeds as follows. We first provide background information on Indonesia's health care system and continue with a theoretical discussion of the CDP framework, resulting in a set of hypotheses. These are followed by a presentation of our methodology, results, and a discussion of our conclusions.

Indonesia's health care system and CHCs' characteristics

Indonesia is a huge archipelagic country with a population of about 237 million (in 2010) inhabiting about 6,000 out of more than 17,000 islands. In 2010 population density was estimated at 124 persons per km^2 and the annual population growth rate has amounted to 1.4% over the past ten years.[3] The country contains 34 provinces, 514 districts, and 7,024 sub-districts with each sub-district comprising sub-sub districts and/or villages.

CHCs are government health institutions at the sub-district level. Besides CHCs, local government, private and public organizations may provide health care to communities. In order to reach communities at the village level, CHCs are allowed to open health centers, called *Pustu,* in each village. CHCs can also request mobility facilities (i.e. boats and motorcycles) to transport health staff to reach remote areas. Furthermore, CHCs communities can take the initiative to establish two types of branches at the village level, *Polindes* providing pre-natal and maternity care, and *Poskesdes* providing primary care. In both cases, CHC health staff provide care and are assisted by volunteers in the village. In case a CHC has insufficient health staff to work in all the *Polindes* and *Poskesdes* in the area, these posts have restricted opening hours on certain days only. Figure 3-1 presents the position of the CHCs within Indonesian administrative jurisdiction.

[3] Retrieved from the website of Statistic Indonesia on June 1st 2016: https://www.bps.go.id/Subjek/view/id/12#subjekViewTab3|accordion-daftar-subjek1

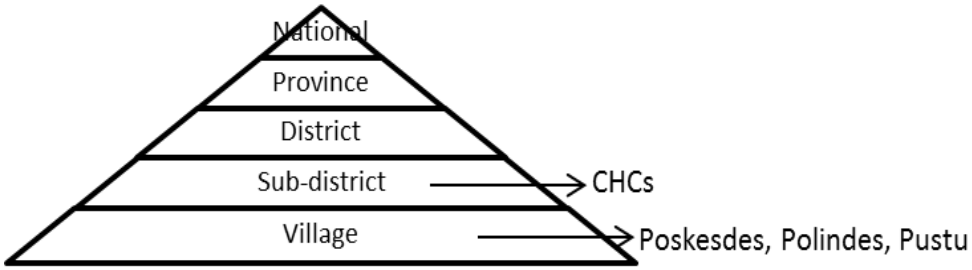

Figure 3-1 The structure of health institutions in Indonesia

In 2011, there were 9321 CHCs, spread over 6773 sub-districts all over Indonesia. (BPS-Statistics Indonesia, 2016). As stated, variation in functions and organization structure of CHCs is allowed as long as they meet the requirements of the Ministry of Health. The government stipulates that each CHC should employ at least eight different kinds of staff: one or more physicians, dentists, midwives, nurses, pharmacists, public health workers, nutritionists, and environmental health workers (2004 and 2015 MoH Decree No. 128 on *Puskesmas* (CHCs)).

CHCs can also vary in the number of horizontal units. They can have inpatient care facilities (CHCs with beds), a 24-hour facility for obstetrics neonatal care (also called *Poned*), and/or an ambulatory service. The MoH determines the requirements that need to be met for additional functions to be granted. For example, a CHC may have inpatient care if the sub-district where the CHC functions is far from the referral service (i.e. a hospital).

Theoretical background

We apply the CDP framework as introduced by Marathe et al. (2007) to develop hypotheses about the determinants of CHC efficiency. The CDP framework was built to explain the efficiency of health care centers and proposes three antecedents of organizational efficiency: contextual factors, organization design, and the fit between context and design. The core idea is that organizational performance is determined by an organization's ability to adapt its organizational structure to contextual factors (Marathe, et al., 2007). The framework thus closely relates to the assumptions of contingency theory in organizational sociology because of its focus on the relationship between organizational performance, internal (organizational design) and external (contextual) contingencies (Donaldson. 2006; Marathe, et al., 2007).

To date, the CDP framework has applied infrequently. This might be due to the lack of explanatory empirical studies on organizational efficiency in general (Pelone, et al., 2015) and the lack of theoretical elaboration of the relation between organization design, contextual factors and organizational efficiency in the CDP framework in particular (Marathe, et al., 2007). We address these gaps by providing a precise conceptualization of organization design (in terms of horizontal, vertical, and spatial differentiation) and by theoretically elaborating the relation between organization

design, context factors, and efficiency. We start by elaborating on the relation between context and CHC efficiency.

Contextual factors and Community Health Centers efficiency

Contextual conditions can explain variations in organization performance and efficiency, since they can affect organization's outputs both directly or indirectly (Marathe, et al., 2007; Ortiz, et al., 2010). One main reason for introducing CHCs into the Indonesian health sector was to provide primary health care for the poor and uninsured, a category of citizens who usually live in remote areas, where physical access to health care is severely hampered by the absence of a transportation infrastructure (Marathe, et al., 2007; Ortiz, et al., 2010; Cordero Ferrera, et al., 2014). This strong interrelation between poverty and remoteness of a CHC service coverage area poses a double challenge to Indonesian policy makers and CHC practitioners (Fritzell, et al., 2013).

First, high poverty levels, i.e. the percentage of poor people in a service coverage area, often reflect more severe health problems in that area (Ortiz, et al., 2010). Poverty is associated with lower education levels and less healthy food consumption patterns, which relate to high morbidity rates and complex health challenges (Wagstaff, 2002). CHCs located in poorer areas, therefore, may face higher and more complex health problems. Despite the fact that the poor have health insurance, which would stimulate them to go to the CHC if they have health problems and provides CHCs with the funds to treat this target group, the insurance facility does not alter the fact that the poor face more (complex) health challenges to begin with. Hence, compared to their counterparts in wealthier areas, CHCs in areas with a high proportion of poor people are likely to face more severe health problems. Lower efficiency levels may be the result because reaching the same outcome requires higher investments.

Second, the impact of poverty in a CHC's coverage area is likely to be exacerbated if it is situated in a remote area. Not only do the latter host a higher percentage of poor citizens than non-remote areas, CHCs in these regions are less accessible due to the lack of infrastructure. This might further inhibit patients to come to the CHCs in the first place, or it may take them longer to get there. Better access to health care may mean that more patients will come to the CHCs in time (Utomo, et al., 2011), which will increase a CHC's output and thus its efficiency (assuming that the input is similar to other CHCs). We thus hypothesize that:

H1 (Context – poverty and remoteness): (a) The higher the poverty rate in a service coverage area, the lower the CHC efficiency, and (b) the negative effect of poverty on CHC efficiency is stronger in remote areas than in non-remote areas.

Organization design: horizontal and spatial differentiation and Community Health Centers efficiency

Organization design also influences CHC efficiency since it impacts on how organizations transform input into desired output (Marathe, et al., 2007). Organization

design refers to structural aspects in organizations, such as the degree of formalization,[4] centralization,[5] and complexity[6] (Mintzberg, 1980; Heffron, 1989). We focus specifically on the degree of complexity in CHCs as the main organization design factor, since CHCs in Indonesia are quite similar in their degree of formalization and centralization: they have flat hierarchies and minimal formalization, and because they consist of health staff professionals and can thus be considered professional organizations (Mintzberg, 1980).

Organization complexity is usually subdivided into three dimensions (Mintzberg, 1980; Heffron, 1989; Ethiraj & Levinthal, 2004; Glenn & Malott, 2004; Andrews, et al., 2016). First, the degree of *vertical differentiation* or the number of hierarchical layers; Second, the degree of *horizontal differentiation* or the number of units in the same hierarchical layer; Third, the degree of *spatial differentiation* or the number of geographically separate units. For the purpose of our study, we focus on *horizontal and spatial differentiation*, given that CHCs are flat organizations and thus lack vertical differentiation.

The relationship between horizontal and spatial differentiation in an organization and its efficiency is ambivalent (Hall & Tolbert, 2005). It may affect efficiency positively (Glisson & Martin, 1980) negatively (Carillo & Kopelman, 1991), or not at all (Dalton, et al., 1980).

We expect the relationships between horizontal and spatial differentiation and efficiency to have an inverted U shape. To start with horizontal differentiation, a high degree of horizontal differentiation can help an organization to perform more efficiently: by dividing tasks among various kinds of staff in different units or departments, specialized staff can focus on the tasks they are most qualified for so that more efficient task completion can be achieved. This implies a positive, linear effect between the degree of horizontal differentiation and efficiency (Glisson & Martin, 1980; Carillo & Kopelman, 1991).

However, a high degree of horizontal differentiation also creates coordination costs among units for making decisions and taking action. There thus might be a critical point at which the benefit of a high degree of horizontal differentiation no longer outweighs the transaction cost it creates. Furthermore, there is evidence that managers tend to ask for more horizontal differentiation than may be needed, since having more units and people under managerial control increases their power and status (Wittek & Witteloostuijn, 2013). In such circumstances, the coordination effort and time required to achieve organizational action will cost more than the benefits of horizontal differentiation and be detrimental to organizational efficiency (Armandi & Mills and Jr., 1982; Glenn & Malott, 2004; Andrews, et al., 2016). This suggests a critical point at which the degree of horizontal differentiation no longer contributes to but hampers efficiency. We thus expect that efficiency first increase with horizontal differentiation, but decreases with further differentiation after it has exceeded a threshold value.

[4] This is the degree to which rules and procedures are present in written form.
[5] This is the degree to which authority is in the hand of one or more managers/owners.
[6] This is the degree and nature of the division of labor and specialization.

A similar reasoning applies to the relationship between spatial differentiation and CHC efficiency: a high degree of spatial differentiation may contribute to organizational efficiency, especially in organizations with substantial autonomy, because autonomy may facilitate localized adaptation and tailor-made service provision (Ethiraj & Levinthal, 2004; Andrews, et al., 2016). However, spatial differentiation also creates transaction costs and managers may try to expand the number of spatial units for the same reasons we argued for with regard to horizontal differentiation. Hence, the degree of spatial differentiation might be higher than needed, which results in such high transaction costs for coordination that this starts to hinder efficiency. Consequently, our hypothesis on organization design reads:

H2 (Organization design: horizontal and spatial differentiation): The effect of (a) horizontal differentiation and (b) spatial differentiation on CHC efficiency is curvilinear and has an inverted U shape.

The context-design fit and Community Health Centre efficiency

Also in Indonesia, one goal of public administration reform is to provide more responsive public services by granting more autonomy to public organizations (Nieto Morales, Wittek, & Heyse 2013). More responsive services can be achieved when organization design fits well with contextual circumstances and is expected to result in better organizational performance and efficiency (Silince, 2005; Donaldson, 2006). Since Indonesian CHCs are quite autonomous in deciding their operational strategy, how to organize themselves and their budget allocations, we expect that these centers will adjust the degree of horizontal and spatial differentiation to the characteristics of their service coverage area, to achieve a fit that will lead to effective and efficient health care provision (Silince, 2005; Donaldson & Joffe, 2014)

We assume that horizontal and spatial differentiations are related to two aspects of a CHC's context. Remoteness is a context condition representing the degree of difficulty to access a CHC, which in turn may affect their efficiency (Utomo, et al., 2011). CHCs operating in remote areas are therefore likely to increase their spatial differentiation in order to be able to reach out to communities in dispersed areas. This, in turn, will improve CHC efficiency. Hence, our remoteness-spatial differentiation hypothesis reads:

H3a (Remoteness-spatial differentiation fit): CHCs with high spatial differentiation operating in remote areas will be more efficient than CHCs with low spatial differentiation operating in remote areas. This will flatten the inverted U shape predicted for the relationship between spatial differentiation and CHC efficiency.

Poverty is a context condition representing a low health status of the community (Ortiz, et al., 2010) therefore requiring more complex tasks for CHCs. However, as mentioned previously, the Indonesian government allows CHC managers to propose additional units or resources, such as inpatient facilities. Furthermore, they can increase the diversity of health staff, since different expertise may be needed to handle different diseases. Therefore, a higher poverty level of a service coverage area

is likely to trigger the CHC to have horizontal units more for higher efficiency. Hence, our poverty-horizontal differentiation hypothesis reads:

H3b (Poverty-horizontal differentiation fit): CHCs with high horizontal differentiation operating in poor areas will be more efficient than CHCs with low horizontal differentiation operating in poor areas. This will flatten the inverted U shape predicted for the relation between horizontal differentiation and CHC efficiency.

Methods

Data and sample

Data on CHC health performance in Indonesia are hard to find because of the wide geographical dispersion of CHCs and the under-developed infrastructure of information management systems in the Indonesian health sector. This study is therefore based on a relatively small sample of 598 CHCs in 2011 (i.e. 6.4% of the total population of CHCs). We combined two data sources to create this sample. The year 2011 was chosen because it was the most recent year for which most information in these two data sources was available.

First, we retrieved CHC data for 2011 published on the MoH's official website.[7] This CHC database includes information on the number and nature of CHC health staff and the CHC organizational units, both in terms of horizontal and spatial differentiation.

Second, we combined this information with data retrieved from 37 districts' health profile reports published by the Department of Health of each district in 2011. Some reports were downloaded from the official MoH website, others from district websites. These reports present information per CHC.

Data collection was arranged and coordinated by the MoH through the Department of Health in each district. The MoH determined the data collection instruments, indicators, and structure of the report in order to ensure the level of uniformity necessary for aggregating information to the provincial and national level.

The report has three parts. The first describes the context of the region in terms of population size and number of infants, for example. The second provides information about the health care services and community health conditions, such as the number of visitors and the number of vaccinated infants. The third provides information about the health institutions, for example, the number of health staff in CHCs and the number of hospitals.

Since 2005, districts are expected to provide a health profile report annually. However, not all districts comply, and only a small fraction publishes the report on their websites, which limited the number of available reports. The reasons why some CHCs

[7] For example, the health profile of Kabupaten Tangerang can be downloaded from this link http://www.pusdatin.kemkes.go.id/resources/download/profil/PROFIL_KAB_KOTA_2011/P.Banten_Kab.TANGGERANG_11.pdf accessed on April 27th 2017

do not publish a health report are not known, but it might have to do with a lack of capacity to create such a report.

Our analysis focuses on 2011, the most recent year for which most health profile reports were published (47 with information about 735 CHCs) of which 37 districts (with information about 598 CHCs) provided the complete data required for the present study. To explore the representativeness of our data, we compared the infant mortality rates of the regions covered in the reports to the national average. The country average of infant mortality rates according to the data of health profiles from 33 provinces[8] was approximately 20.69 per 1000 live births in 2011. This suggests that the selection bias in our sample seems to be relatively small.

Calculating the dependent variable with Data Envelopment Analysis

As in previous CDP studies,[(Marathe, et al., 2007)] we analyzed CHC efficiency in two stages. First, we estimated CHC efficiency using data envelopment analysis (DEA). Second, we tested our hypotheses with Tobit regression analysis, linking the estimated efficiency levels of CHCs to the predictors in these hypotheses. We now first discuss how the dependent variable was constructed.

DEA is an analytical tool to benchmark an organization's performance to the maximum attainable performance of similar organizations (Farell, 1957; Charnes, et al., 1978; Coelli, et al., 2005) and for later contribution (see Pelone, 2015) for a review of efficiency analysis applications in primary health care). This maximum attainable performance is estimated by applying linear programming methods to a sample of organizations that use similar inputs to produce similar outputs. One of the advantages of DEA is that it can deal with multiple inputs and multiple outputs. By virtue of the method, organizations (often labeled DMUs, 'decision-making units') are benchmarked only against the maximum performance of organizations that use the inputs and produce the outputs in roughly the same proportions (Coelli, et al., 2005). Another major advantage is that DEA can be used without information about the prices of inputs and outputs. Reliable information, particularly on the prices of outputs, is often lacking in the context of public organizations like the CHCs we study. Given that we consider only the efficiency with which given inputs are processed into outputs and do not analyze whether the cheapest inputs are used and the most profitable outputs are produced, our efficiency concept is what DEA scholars call 'technical efficiency' (as opposed to 'cost efficiency').

Figure 3-2 illustrates how efficiency scores are determined. The example presents a context in which a single input (I) produces two outputs (O1 and O2). Six DMUs are depicted in the space that shows how much of O1 and O2 is produced with one unit of I. The DMUs labeled A, B, C and D defines the 'envelope' or 'frontier', the combinations of O1 and O2 that appear to represent maximum performance. The performances of all six DMUs suggest that it is not possible to produce anything more

[8]Downloadable from the official website of the Ministry of Health, the Republic of Indonesia, http://www.depkes.go.id/?act=page&pg=profil_kesehatan_provinsi

of O1 than A, B, C and D without sacrificing some units of O2. Hence, these four DMUs on the frontier have an efficiency score of 1. DMUs can focus on generating one of the two outputs: A produces a lot of O2 and only a bit of O1, whereas the opposite holds for D. DMUs E and F are inefficient. Given the performance of the DMUs on the frontier, they could produce more of both outputs than they actually do.

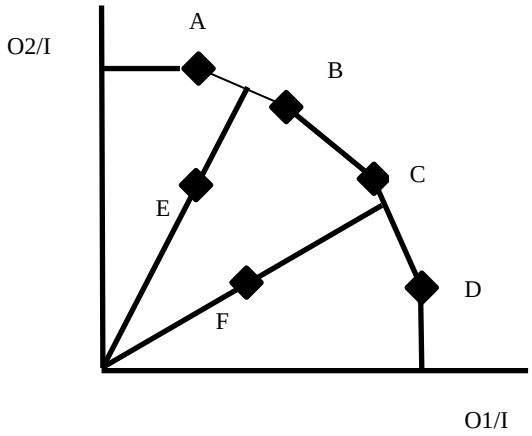

Figure 3-2 Illustration of the estimation of efficiency levels in DEA

Thus, the efficiency scores of E and F are below 1. The efficiency is determined by dividing the actual output levels to what could have been produced according to the point on the frontier that would be attained if the levels of O1 and O2 were increased proportionally. This implies that E is benchmarked on the performance of A and B, while the efficiency score of F is determined by the performance of C and D (F's 'peers'), the efficient DMUs that produce O1 and O2 in roughly the same proportions as F. Efficient DMUs with a very different output profile do not enter the efficiency determination (Coelli, et al., 2005).

Figure 3-2 gives an example of an 'output-oriented' DEA, which obtains efficiency scores by computing by how much outputs could be expanded at given input levels. The alternative is 'input-oriented' DEA, which computes the maximum reduction in inputs for given output levels. We opt for the output-oriented alternative since we feel that CHC managements try to provide as many services as possible with given resources, rather than try to minimize resources with given services provision levels.

The choice of input and output-orientation would have been irrelevant for the efficiency scores if we had assumed a constant returns-to-scale (CRS) technology for the CHC production processes. However, we do not believe that doubling all inputs always leads to doubling the output levels, which would have been the implication of assuming CRS. In our view, it is more appropriate to assume that small CHCs could increase their output more than proportionally to input growth, for example, because opportunities for specialization emerge. The output of large CHCs might not be able to grow at a pace equal to their inputs, for example, because the buildings would become too small to host all staff. Taking issues like these into account calls for a variable returns-to-scale approach. This implies that CHCs are benchmarked against other CHCs

that not only produce their outputs in similar proportions and have a similar input *mix*, but also have similar input *levels*. All analyses have been done using the tool DEAP (version 2.1).[9]

Input and output selection. We restricted the input of the CHCs to human resources. We distinguished two groups, as is often done in previous studies (Akalizi, et al., 2008). The first group is clinical staff, who directly provides care to patients. This group may consist of staff with a higher educational background (e.g. physicians, dentists, and specialists) and a middle education background (e.g. midwives and nurses). The second group is the non-clinical staff, who do not provide direct care to patients. This group may contain non-paramedics (nutritionists, public health and environmental health workers, and pharmacists) and laboratory staff.

We defined the output of CHCs based on their main goals: providing primary health care and reducing infant mortality rates. Since infant mortality rates are reduced by vaccination (Dube, et al., 2013) and spacing delivery (Mustafa, 2008; Dube, et al., 2013) and if deliveries are attended by health staff (Titaley, et al., 2008), we included these factors as CHC outputs: (1) number of vaccinated infants (Akalizi, et al., 2008), (2) number of active contraception users (females of childbearing age), and (3) number of deliveries attended by health staff (Akalizi, et al., 2008). See Table 3-1.

To reflect the task of CHCs to provide primary care, we included (4) number of visitors (Akalizi, et al., 2008). Furthermore, we included (5) number of health promotion activities, since these can help reduce infant mortality rates by means of promoting breastfeeding (de Souza, et al., 1999; Dube, et al., 2013; Mustafa, 2008) and washing hands before feeding infants (Dube, et al., 2013).

Table 3-1 Input and output variables

Variables	Definition
Inputs	
Doctors	The number of physicians, dentists, and specialists
Midwives	The number of midwives
Nurses	The number of nurses
Non-Paramedic	The number of public health staff, nutritionists, environmental health staff, pharmacists
Laboratory Staff	The number of laboratory staff
Outputs	
Vaccinated infants	The number of infants who are vaccinated
Active users of contraceptive methods	The number of couples who use contraceptive methods
Deliveries attended by health staff	The number of deliveries attended by health staff
Health Promotion	The number of health promotion activities in a year
Visitors	The number of visitors

[9] See http://www.uq.edu.au/economics/cepa/software.php, accessed in March, 2014, with user guide http://www.owlnet.rice.edu/~econ380/DEAP.PDF.

We estimated the CHCs' technical efficiency scores by analyzing the input and output variables of 598 CHCs in two steps. First, we did a robustness test by running DEA for different combinations of inputs and outputs to see whether the outcomes varied considerably. This was not the case and hence we proceeded with the input and outputs as summarized in Table 3-1. To test for the presence of outliers we redid the DEA analysis involving only the non-efficient CHCs. When efficient CHCs from the DEA were excluded, the technical efficiency of CHCs generally increased only slightly with no changes in ranking. Hence, we did not identify strong outliers and our final sample consisted of 598 CHCs.

Independent variables and measurements

Organizational *design* is subdivided into the degree of horizontal and spatial differentiation. *Horizontal differentiation* is operationalized by two indicators:

1) The number of different types of health staff working in a CHC, also called the *staff mix*. For example, a CHC with physicians, midwives, and nurses has a health staff mix of three, and a CHC with only physicians and midwives has a health staff mix of two. Ten possible types of health staff can work in CHCs.
2) The *quantity of horizontal units* in a CHC ranges from 0 to 3. This is the sum of the presence of *Poned* (24-hour care), *beds* or inpatient care, and *ambulatory service*.

Spatial differentiation is operationalized as the presence of CHC staff or offices in separate locations. In the Indonesian case, this refers to the number of *Pustu*, *Poskesdes,* and *Polindes*. *Contextual factors* in each CHC service coverage area are operationalized as follows:

1) P*overty* rate is reflected in the percentage of poor people [10] (Badan Pusat Statistik, 2016) in a CHC's coverage area (Marathe, et al., 2007). In our data, poverty rates may reach 100% since this figure also includes nearly poor people.
2) The level of *remoteness* is categorized in two levels to information on the MoH website.[11] For the purposes of our study, we distinguish between remote (1), and non-remote (0) areas.

Control Variable. Following suggestions from previous research to avoid statistical bias, we control for *population* size in a CHC's service coverage area (Cordero Ferrera, et al., 2014). Though the MoH's decision to create a CHC in a region is based on the population in a service coverage area reaching a certain threshold, CHCs still show

[10] The data on poor people in the health profile is based on the Social Economic and Demographic Survey 2010. Poverty was measured by Central Bureau of Statistics (CBS) Indonesia using an indicator based on basic needs.

[11] The remoteness level is defined by the regulation of the Ministry of Health.[(Ministry of Health Indonesia, 2007) A *remote* area is characterized by three main indicators: (1) its geographical position (difficult to access, disaster prone, in mountainous, inland, and swamp areas); (2) public transport is available maximally twice a week, required travelling time (return) of at least 6 hours; (3) socio-economic conditions: lack of staple goods, insecure or conflict area. Added to the characteristics of remote areas, a *very remote* area also has the following features: (1) Geographical position: tiny island, in outer or border area of the country; (2) no or no routine public transport within the area, the area can only be accessed by plane from other places, the transportation facility may be cancelled because of problematic weather conditions.

some variation in the size of their service coverage areas. Since the establishment of a CHC is also related to guaranteeing accessibility to primary health care, CHC are allowed to establish in areas with a population size lower than the government threshold for establishing a CHC, such as is often the case in remote areas.

Tobit censored regression analysis

In the second stage of the analysis, hypotheses were tested with Tobit censored regression, a method regularly used to analyze variation in technical efficiency (Cordero Ferrera, et al., 2014; Jehu-Appiah, et al., 2014; Varabyova & Müller, 2016). Tobit regression removes bias that would result from applying a standard linear regression framework to analyze truncated dependent variables (such as DEA efficiency scores that range from 0 to 1) (Tobin, 1958; Simar & Wilson, 2007).

Results

Organizational efficiency analysis

Table 3-2 presents descriptive statistics for the input and output variables. Some input indicators have zero as the minimum (i.e. doctors, nurses, non-paramedics, and laboratory staff). This indicates that some CHCs do not meet the minimum health staff standard as determined by the MoH. Some output indicators have zero as the minimum (i.e. promotion, active contraceptive users, and attended deliveries). This indicates that some CHCs did not generate some core outputs. The data also show quite some variation in the various output levels.

Table 3-2 Descriptive statistics for input and output variables

Variables	Minimum	Maximum	Mean	SD
Inputs				
Doctor	0	13	2.14	1.35
Midwives	1	66	13.78	9.62
Nurses	0	45	10.51	6.41
Non-paramedic	0	21	4.57	3.05
Laboratory staff	0	5	0.76	0.85
Outputs				
Infant vaccinated	33	2545	538.69	380.03
Promotion	0	5145	230.38	433.51
Active contraceptive users	0	25982	4678.29	4133.43
Attended deliveries	0	2630	529.69	372.68
Visitors	36	179636	22325.25	19895.96

We estimated CHC efficiency by analyzing the input and outputs indicators as described in Table 3-2. Table 3-3 presents the resulting technical efficiency (TE) scores of CHCs.

Table 3-3 Technical efficiency scores

Efficiency score interval	Frequency	%
1	84	14.05
0.91-0.99	26	4.35
0.81-0.9	37	6.19
0.71-0.8	46	7.69
0.61-0.7	41	6.86
0.51-0.6	61	10.20
0.41-0.5	67	11.20
0.31-0.4	61	10.20
0.21-0.3	83	13.88
0.11-0.2	72	12.04
0.01-0.1	20	3.34
Mean 0.64	*598*	*100*

Table 3-3 shows some variation in efficiency scores. 84 (14%) CHCs are efficient (TE score of 1), and the remaining 514 (86%) CHCs are inefficient (TE score range between 0-1). We divided the inefficient scores (0.99–0.01) into ten intervals. The most populated interval is between 0.21–0.30, associated to 83 CHCs (14% of the sample). 234 (41%) of inefficient CHCs had a TE score between 0.99 and 0.60. 364 (59%) CHCs had a TE score of less than 0.60. This variation suggests that not all CHCs are equally capable of finding the ultimate design and organization for their organizations to operate most efficiently.

Descriptive statistics

Table 3-4 presents descriptive statistics, distinguishing between remote and non-remote areas. The sample size with complete information on all variables is N=355 (from N =598).

Table 3-4 Descriptive statistics

Variable	CHC in remote area					CHC in non-remote area				
	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
Independent Var.										
N of Branch	100	0	11	3.13	2.03	320	0	9	2.39	1.51
N of Polindes	91	0	27	8.74	6.00	300	0	23	6.28	4.31
N of Poskesdes	85	0	8	0.62	1.18	305	0	9	0.60	1.23
N of Staff-mix	100	2	9	6.51	1.67	320	4	10	7.50	1.10
N of Horizontal Unit	87	0	3	1.44	0.91	313	0	3	1.18	0.98
Poverty rates (%)	95	8.31	100	58.78	22.75	307	9.08	87.78	35.52	14.73
Dependent Var.										
Efficiency Score	100	0.24	1	0.53	0.22	320	0.30	1	0.79	0.17
Control Var.										
Population (000)	100	1.41	47.85	12.05	8.91	320	5.69	133.05	38.71	19.07
Valid N (listwise)	79					276				

The health staff mix ranges 2–10, with an average of 7. This is noteworthy since the government regulation stipulated a minimal health staff mix of eight. The number of horizontal units ranges 0–3, with a modus of one. The number of spatial units is dominated by the *Polindes*; six per CHC on average. The minimum degree of spatial differentiation is 0, since some CHCs may have no spatial unit. Of all CHCs for which information is available 23.8% are remote (N=420).

The correlation between poverty and remoteness exceeds 0.6, suggesting a multicollinearity problem (Pallant, 2013). To address this, we analyzed the data in two groups; one group of CHCs in non-remote areas (Table 3-5) and the group in remote areas (Table 3-6).

Table 3-5 Correlations between independent variables (CHCs in non-remote areas)

	Variable	1	2	3	4	5	6	7
1	N Branch	1						
2	N Polindes	0.179**	1					
3	N Poskesdes	0.142*	0.165**	1				
4	N Staff-mix	-0.062	-0.138*	0.005	1			
5	N Horizontal Unit	0.004	0.084	0.059	0.156**	1		
6	Poverty rates	0.220**	0.215**	0.050	-0.221**	-0.025	1	
7	Population (000)	0.132*	0.093	0.317**	-0.133*	0.051	-.0024	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 3-6 Correlations between independent variables (CHCs in remote areas)

	Variable	1	2	3	4	5	6	7
1	N Branch	1						
2	N Polindes	0.271**	1					
3	N Poskesdes	0.143	0.382**	1				
4	N Staff-mix	0.206*	0.315**	0.098	1			
5	N Horizontal Unit	0.086	0.367**	0.184	-0.014	1		
6	Poverty rates	0.010	0-.287**	-0.206	-0.233*	-0.164	1	
7	Population (000)	0.321**	0.322**	0.468**	0.373**	0.206	-0.229*	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Tobit regression results

Table 3-7 presents the results of the Tobit regressions. It contains three Models, each containing separate analyses for the sets of remote and non-remote areas. Model A assesses the curvilinear effect of horizontal differentiation (number of horizontal units and staff mix) and organizational context (poverty). Model B adds the curvilinear interaction effect of horizontal differentiation and context (poverty) on efficiency. Model C also adds the curvilinear interaction effect of spatial differentiation.

Table 3-7 Results of Tobit censored regression analysis

Variable	Model A				Model B				Model C			
	Remote (N =79)		Non-remote (N=276)		Remote (N =79)		Non-remote (N=276)		Remote (N =79)		Non-remote (N=276)	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Context												
Poverty	0.002***	0.001	-0.002**	0.001	0.011	0.009	0.026	0.017	0.010	0.010	0.021	0.017
Horizontal Differentiation												
Units	0.063	0.053	0.044*	0.026	0.015	0.145	0.293***	0.077	0.022	0.152	0.281***	0.076
Units^2	-0.020	0.017	-0.023**	0.009	0.004	0.045	-0.125***	0.027	0.008	0.050	-0.121***	0.027
Staff-mix	-0.361***	0.055	-0.233**	0.077	-0.318***	0.074	-0.230**	0.090	-0.327***	0.075	-0.225**	0.090
Staff-mix^2	0.022***	0.005	0.015**	0.005	0.019	0.015	-0.002	0.012	0.021	0.016	0.000	0.013
Spatial Differentiation												
Branch	0.016	0.026	-0.011	0.016	0.009	0.025	-0.015	0.016	0.037	0.086	-0.015	0.051
Branch^2	-0.004	0.004	0.002	0.002	-0.002	0.004	0.003	0.002	-0.011	0.014	0.010	0.009
Polindes	-0.021**	0.009	-0.017**	0.006	-0.020**	0.009	-0.016**	0.006	-0.017	0.024	-0.023	0.021
Polindes^2	0.001**	0.000	0.001*	0.000	0.001**	0.000	0.001*	0.000	0.001	0.001	0.001	0.001
Poskesdes	-0.051	0.031	0.024	0.016	-0.047	0.030	0.029*	0.015	-0.088	0.094	0.063	0.050
Poskesdes^2	0.005	0.004	-0.005*	0.003	0.004	0.004	-0.006**	0.003	0.003	0.023	-0.014	0.012
Controls												
Population (000)	0.017***	0.002	0.006***	0.001	0.016***	0.002	0.006***	0.001	0.016***	0.002	0.006***	0.001
Interaction Effects												
Units * Poverty					0.000	0.002	-0.007***	0.002	0.000	0.003	-0.007***	0.002
Units^2 * Poverty					0.000	0.001	0.003***	0.001	0.000	0.001	0.003***	0.001
Staff-mix * Poverty					-0.002	0.003	-0.007	0.005	-0.001	0.003	-0.005	0.005
Staff-mix^2 * Poverty					0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Branch * Poverty									-0.001	0.001	0.000	0.001

Variable	Model A				Model B				Model C			
	Remote (N =79)		Non-remote (N=276)		Remote (N =79)		Non-remote (N=276)		Remote (N =79)		Non-remote (N=276)	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Branch^2 * Poverty									0.000	0.000	0.000	0.000
Polindes *Poverty									0.000	0.000	0.000	0.001
Polindes^2 *Poverty									0.000	0.000	0.000	0.000
Poskesdes * Poverty									0.000	0.002	-0.001	0.001
Poskesdes^2 * Poverty									0.000	0.001	0.000	0.000
Constant	1.684***	0.175	1.631***	0.286	1.119*	0.562	0.478	0.562	1.188*	0.597	0.678	0.651
R^2	0.76		0.40		0.78		0.42		0.79		0.43	
Adusted-R^2	0.72		0.37		0.72		0.39		0.70		0.38	

*Correlation is significant at the 0.1 level
**Correlation is significant at the 0.05 level
***Correlation is significant at the 0.01 level
****We obtained the value of R^2 by running the linear regression analysis (Stata SE 14.1)

Hypothesis 1a predicted a negative association between poverty and efficiency, and H1b argued that this effect is stronger for remote than for non-remote areas. Model A shows a significant positive effect of poverty for remote areas, and a significant negative effect for non-remote areas. But both effects disappear once interaction effects are added in Models B and C, suggesting that the direct effect of poverty is spurious. Consequently, no evidence is found for H1a and H1b: the proportion of poor people in a service coverage area does not affect a CHC's technical efficiency, and this holds likewise for remote and non-remote areas.

Hypothesis 2a suggested an inverted U shape relationship between horizontal differentiation (measured as the number of horizontal units and the degree of staff mix) and efficiency. The number of horizontal units has a significant positive impact on efficiency, but only in non-remote areas. This effect can be found in all three models. Effect sizes are considerably stronger in Models B and C. There is a negative curvilinear effect of the number of horizontal units, again only for CHCs in non-remote areas. This effect, too, can be found in all three models, and effect size is considerably lower in Model A. According to our curvilinearity diagnostics (see Appendix 10.2), the observed parameters meet the requirements for a significant inverted U shape relationship between the number of horizontal units and efficiency. This effect holds for non-remote areas only. With a turning point at 1.2, efficiency is highest in CHCs with one or two horizontal units and lower for CHCs without a horizontal unit or with more than two horizontal units.

The degree of staff mix has a significant, negative effect on efficiency in all three Models. The more professional roles represented in a CHC, the lower its efficiency becomes. This effect holds for remote and non-remote areas alike. In all three Models, effect sizes are stronger for remote than for non-remote areas. The curvilinear effect for staff mix is significant and positive only in Model A; it disappears once interaction effects are introduced. This suggests that effects of staff mix are linear.

Whereas our findings are in line with H2a, the evidence for staff mix is not: whereas technical efficiency in non-remote areas is highest for CHCs with an intermediate number (N=1) of horizontal units than for CHCs with very low or very high number of horizontal units, technical efficiency for CHCs in remote and non-remote areas alike improves linearly with lower degrees of staff mix.

Hypothesis 2b predicted an inverted U shape relationship between spatial differentiation (measured as the number of branches, *Polindes*, and *Poskesdes*) and efficiency. The indicators measuring spatial differentiation have significant effects in Models A and B, but these effects disappear in Model C, which contains all interaction effects. This means that spatial differentiation does not affect efficiency, in both remote and in non-remote areas. Hence, no evidence could be found for H2b: there is no systematic relationship between a CHCs spatial differentiation and its technical efficiency.

Hypothesis 3a argued that CHCs with high spatial differentiation operating in remote areas will be more efficient than CHCs with low spatial differentiation operating

in remote areas. With none of the indicators measuring spatial differentiation, or its interaction effects having a significant effect on efficiency in Model C, H3a has to be refuted.

According to Hypothesis 3b, horizontal differentiation (number of units, staff mix) pays off predominantly for CHCs operating in poor areas, resulting in poverty flattening the inverted U shape relation between horizontal differentiation and efficiency. The findings are in line with this prediction for the number of horizontal units, but not for the degree of staff mix, for which no significant interaction effects were found. In non-remote areas, there is a significant but weak negative interaction effect between the number of horizontal units and poverty on efficiency. As the curvilinearity, statistics show (Appendix 10.2), poverty indeed flattens the inverted U shaped relationship between the number of horizontal units and technical efficiency, in line with H3b.

The control variable *population* shows significant and positive effects in all Models, suggesting that the CHCs in larger coverage areas tend to be more efficient than CHCs situated in smaller service coverage areas. However, though highly significant, effect sizes are very low.

Discussion and conclusion

Systematic statistical analyses of CHC efficiency are rare, also for the Indonesian context. Using performance information from a sample of almost 600 Indonesian CHCs, the present study revealed large variations in efficiency, and a clear pattern of conditions causing this variation.

Both organizational design and context matter for efficiency. With regard to design, horizontal differentiation, but not spatial differentiation, has an impact: none of the indicators for spatial differentiation – the quantity of branches, *Polindes, Puskesdes* – shows a systematic association with efficiency. As background interviews with four CHC directors reveal, this may be because CHC management will react to declining numbers of patients either by closing down some of their *Pustu* and *Poskesdes* or by relying on alternative means to reach out to remote areas, like using ambulances as mobile CHCs.

In contrast, both horizontal differentiation measures affect efficiency. CHCs with a low degree of *staff mix* (number of roles present in its staff) outperform those with a higher staff mix. This linear negative association holds for CHCs in both remote and non-remote areas, and the effect size is the second strongest in the study. The effect of staff mix holds irrespective of the three context conditions investigated here: remoteness, poverty, and the size of service coverage area.

Remoteness matters for the impact of the second organizational design condition, the *number of horizontal units*. Efficiency rates are highest for CHCs with an intermediate number (range 1–2) of horizontal units, but this effect holds only for CHCs in non-remote areas. The regression coefficient represents the strongest effect size in

our study. Furthermore, the impact of the number of horizontal units becomes weaker to the degree that the proportion of poor people increases in a CHC's service coverage area in non-remote areas. This implies that poverty may cancel out the eventual efficiency benefits a CHC may realize through keeping an intermediate number of horizontal units.

In sum, although the context conditions poverty and remoteness affect CHC efficiency, this effect is not direct. This conclusion is particularly relevant from a policy perspective. Being the first study to disentangle the joint impact of two closely related context conditions, a CHC's remoteness and the proportion of poor inhabitants in its service coverage area, our findings show that the socio-economic status of the population in its area does not directly influence CHC efficiency. Furthermore, in non-remote areas, the indirect effect of poverty – in the sense of tempering the efficiency gains from an intermediate number of horizontal units – is weak. CHCs with larger service coverage areas do slightly better, but this effect is weak. A third context condition has a direct effect: CHCs with larger service coverage areas do slightly better, but this effect is weak, too.

Some limitations to this study have to be taken into account when interpreting its results. First, one of the reasons why some relationships do not show up as strongly as expected based on the theory relates to the fact that efficiency levels are not observed, but estimated in the first stage. Consequently, the efficiency levels that we use as observations of the dependent variable contain some measurement error. Second, this study is based on cross-sectional data. We, therefore, could not analyze the relationship between CHC efficiency and its determinants over time, for example, because of changes in organizational design. Third, by splitting the sample into non-remote and remote areas, and given that the sample of remote CHCs is substantially smaller than the sample of non-remote CHCs, this might partly explain the lack of statistical significance in the analysis. Finally, we measured CHC input in terms of the number of staff available, not in terms of the actual hours they work. For example, a good nurse in a well-organized CHC in a poor and therefore unhealthier environment would have to be helping people almost continuously (because demand is higher), whereas her similar colleague working in a similar CHC located in a rich area might have less work to do because of a lower demand for care. These fluctuations in working hours could also explain differences in CHC efficiency but are not included in the analysis.

Nevertheless, the findings of this study suggest that the CDP framework is a useful theoretical point of departure for modeling variations in CHC efficiency. Future studies may also benefit from a comparative assessment of high-quality data on the *quality of care* provided by CHCs – a key dimension that the current study could not address.

FOUR

Community Health Center Efficacy and Skill-Mix of Professionals[12]

Abstract

The Indonesian government encourages the practice of skill mix in its community health centers (CHCs), requiring a minimum standard of eight skills to execute the four basic CHC functions, assuming that skill complementarity is key to efficacious service provision. Alternatively, it could be argued that certain skills in CHCs can be substituted by other skills (or staff) and can thus lead to similar efficacy levels. In addition, since CHCs have the authority and autonomy to allocate resources and determine their operational strategy, they might adapt the skill mix to the context, so that the skill mix might differ depending on the circumstances. We therefore inquire which combination(s) of skills (defined as professions) lead to high efficacy in Indonesian CHCs. We define four efficacy indicators, representing the outcomes of the four CHC functions. We divide the possible range of staff positions over these four functional domains, determined by who has the prime responsibility to execute tasks in this domain. We analyze job descriptions to derive expectations of what staff members could substitute for each other. We use a data set of 598 CHCs derived from health profile reports in 2011 and fuzzy-set QCA to explore the skill combinations that lead to high efficacy pathways. The findings show that high efficacy CHCs have skill mixes ranging from five to seven skills. All function groups are usually present, indicating complementarity. We find evidence for *within group substitution* but not so much for *between-group substitution*.

Keywords: Skill-mix configuration, community health centers, substitution, complementary, efficacy, Indonesia

[12] This chapter is co-authored with Rafael Wittek, Fernando Nieto Morales, and Liesbet Heyse.

Introduction

Community health centers (CHCs) are front-line organizations in national primary health care systems that are tasked with providing equal, accessible and affordable health care that meets the demands of local communities effectively and efficiently (Starfield, Shi, & Macinko, 2005; Groenewegen, Heinemann, Greß, & Schäfer, 2015; Starfield, 2012). Many countries invest in improving CHC capacity in order to meet these goals (Groenewegen, Heinemann, Greß, & Schäfer, 2015). Since 2004, the Indonesian government has invested fiscally in CHC capacity by transferring the health budget to local governments as part of its decentralization policy in the health care sector.

To meet health care related goals, it is not only important that CHCs have sufficient budget to hire staff, but also that CHCs can draw upon the right kind and combination of health care skills, also referred to as 'skill mix'. Skill mix is defined in two ways. First, it can refer to the variation in staff professions that work in CHCs to meet health care demand (Buchan & O'May, 1999; Groenewegen, Heinemann, Greß, & Schäfer, 2015; Antunes & Moreira, 2013; Dubois & Singh, 2009). For example, a CHC with a doctor, a nurse and a midwife has a different skill mix than a CHC with a doctor, a nurse and a nutritionist. Second, skill mix can also refer to specific skills individual staff members possess and the variation therein among staff (Buchan & O'May, 1999). For example, a doctor can have a variety of skills: diagnostics skills, administrative skills and supervision skills.

Paying attention to the skill mix in primary health care organizations is argued to solve at least two problems. First, it may help address the problem of an imbalanced distribution of skills in primary health care organizations, which is quite common in both developed and developing countries (Dussault & Franceschini, 2006; Global Health Workforce Alliance and World Health Organization, 2014; Boenheimer & Smith, 2013). For example, doctors are more reluctant to be positioned in remote areas compared to nurses. In such circumstances, nurses can partly be *substitutes* for doctors, by fulfilling some of the doctor's tasks (as reviewed by Antunes, et al., 2013; Dubois, et al., 2009; Horrocks, et al., 2002). This has the additional benefit of cost containment, because hiring an extra doctor is more expensive than hiring an extra nurse (Dubois & Singh, 2009). Second, a broad skill mix can contribute to *complementarity* since more types of health care services can be provided. A broad skill mix can help address an increasing variety of health problems in a community, for example due to the increase of chronic diseases as a result of aging populations (Groenewegen, Heinemann, Greß, & Schäfer, 2015) or the increase of multiple morbidity causes, such as traffic accidents and environmental degradation (The World Health Report , 2008).

The complementarity argument is related to the preference of many health care institutions and governments to standardize the skill mix in health care (Buchan & Calman, 2004; Groenewegen, Heinemann, Greß, & Schäfer, 2015). The assumption seems to be that a minimum skill mix will contribute to meeting national health care goals by ensuring sufficient complementarity in skills in primary health care

organizations. The Indonesian government has set a minimum standard of eight health care staff types that should be available in a CHC (Ministry of Health Decree No. 128/2004). However, few studies have investigated whether a minimum skill mix actually contributes to meeting national health care goals by means of complementarity. Most studies on health care skill mix are exploratory and descriptive, focusing predominantly on doctors and nurses (as reviewed by Antunes, et al., 2013; Groenewegen, et al., 2015). While these studies present valuable insights, they rarely investigate other types of skills. Moreover, only a few studies evaluate the relation between skill mix and health care outcomes or efficacy (as reviewed by Buchan, et al., 2002; Buchan, et al., 2004; Groenewegen, et al., 2015; Richardson, et al., 1998). This study aims to fill this gap in research by studying the relationship between a broader skill mix and CHC efficacy in Indonesia.

The literature on the relation between skill mix and health care efficacy or outcomes provides two arguments against the complementarity assumption. First, the relation between skill mix and CHC performance might be contingent on organizational characteristics and the context of health care institutions (Dubois & Singh, 2009). For example, the type and composition of skill mix may be related to the size of the organization, variation in health care demand and other contextual factors (Buchan & Calman, 2004; Groenewegen, Heinemann, Greß, & Schäfer, 2015). Hence, a standard set of skills might not necessarily contribute to good health care performance in CHCs: it might require different skill-mix context-related recipes or configurations. This might also hold for Indonesia given that Indonesian CHCs have been granted the autonomy to decide on the strategy, functions and organization design of their centers. This gives CHCs the freedom to decide how to use their resources best to respond effectively to local community health needs and conditions, which might also be reflected in different skill-mix configurations. Given that more than 50% of CHCs did not meet the government standard of eight skills in 2011 (our data source, compiled health profile reports, 2011), it is worthwhile studying whether these CHCs perform less well than CHCs that do meet the government's skill-mix standard. Second, and related to the first argument, it has been suggested that task substitutions could contribute to well-performing CHCs since it might be a way of capitalizing on role overlap in staff tasks (Buchan & Poz, 2002; Dubois & Singh, 2009; Antunes & Moreira, 2013).

Based on the above, this paper addresses two research questions: First, what skill-mix configurations relate to high CHC efficacy in Indonesia across a number of health outcomes? Second, to what extent and how do substitution or complementarity mechanisms explain the relation between skill mix and high CHC outputs?

This study contributes to skill-mix research in three ways. First, we provide insight into the nature of skill mix in Indonesian CHCs, whereas most health care skill-mix studies are conducted in the context of the UK, US and Australia, with skill-mix studies in developing countries remaining scarce. Second, we provide an answer to the question whether the relation between different skill-mix patterns and CHC effectiveness can be explained by means of substitution and complementary mechanisms. Third, we use fuzzy-set qualitative comparative analysis (fsQCA) to

identify skill-mix patterns and their relation to CHC outcomes, a method that to our knowledge is novel in the field of health care skill-mix research.

Complementarity and substitution of health care skills in Indonesian Community Health Centers

Research suggests that skill mix can positively contribute to health care efficacy by means of two mechanisms: complementarity and substitution. We first discuss the primary goals and functions of Indonesian CHCs, and then skill complementarity and skill substitution in the same context.

Primary goals and functions of Community Health Centers

Indonesia's primary health care system was established in 1968, CHCs as front-line units. Besides CHCs, private and non-profit organizations may also provide primary health care to communities. Government-led CHCs are situated in the sub-district level, so they can reach out to patients locally. In 2011 (the year for which we collected CHC data),there were 9,321 CHCs, spread over 7,024 sub-districts throughout Indonesia, providing primary care to about 237 million inhabitants on 6,000 islands (The Ministry of Health the Republic of Indonesia, 2012).

The government regulates the establishment of each CHC. This regulation mandates that CHCs have a minimum of four functions. First, they provide primary health care, as the front-line health institution that the community can visit first when they have health problems. The second function is to provide mother and infant care, including antenatal and postnatal care. The third function is to assist in preventing infectious diseases, for example through immunization programs, and to provide immediate care in the case of outbreaks of infectious diseases. The fourth function is to conduct health promotion by providing information to the community about healthy lifestyles, including contraception use to prevent unplanned pregnancy (MoH Decree no.128 / 2004 on *Puskesmas* CHCs). If patients require more complex care, the CHC will transfer them to hospitals or other referral services.

Skill complementarity in Indonesian Community Health Centers

The Ministry of Health requires CHCs to have a minimum mix of eight skills (MoH Decree no.128 / 2004 on *Puskesmas* (CHCs)), so they can properly fulfil the four functions. The eight kinds of skills/staff required are: physician, dentist, midwife, nurse, pharmacist, public health official, nutritionist, and environmental health officer. Besides staff fulfilling the minimum requirement, there might also be laboratory staff and specialists.

The assumption behind the government regulation is that a broad skill mix (in terms of professions) is needed to meet the health demands in CHC coverage areas: having staff in a CHC that meets this minimum mix will facilitate complementarity in health care service provision, so that a more diverse range of health problems can be

addressed. Hence, one would expect that CHCs with a broader mix of skills will achieve high efficacy in all four functional domains (primary care, mother and child care, prevention and promotion) compared to CHCs with less diverse skill mixes.

Nevertheless, there is evidence that a broader skill mix could negatively influence the efficacy of CHCs. For example, a broad skill mix may increase transaction costs in health care organizations, particularly in large teams, since health staff require more time to coordinate their actions and inform each other about their work so that less time and fewer resources are available to provide direct care to patients (Barr, 1995). It may also lead to diminished continuity of personal interaction between patients and health care staff in providing care, given that multiple tasks need to be implemented by multiple staff (Schers, et al., 2002).

Skill substitution in Indonesian Community Health Centers

Another argument in the literature is that some health care skills can be substituted by other skills due to (partial) overlap in roles and tasks among staff (Buchan & Poz, 2002; Dubois & Singh, 2009; Antunes & Moreira, 2013), suggesting that a minimum skill-mix requirement might not be necessary for a health facility to be effective.

In order to identify which skills in an Indonesian CHC can be substituted by other skills, we reviewed previous studies on health staff workers in Indonesia and other developing countries (Global Health Workforce Alliance and World Health Organization, 2014; Global Health Workforce Alliance, 2013; Syah, et al., 2015), as well as job descriptions, blogs and other information sources that describe the tasks of these CHC professions. From these sources we map which professions have the first responsibility to execute a particular health care task and which professions can substitute. The summary of this analysis is presented in Appendix 10.3. We used this information for two purposes.

First, based on the description of each health profession, we classified the skills in CHCs in four groups that represent the four basic functions of CHCs:

1) Maternity and new-born infant care are mainly provided by midwives (MW) with support from a GP (general practitioner) when needed.
2) Preventive and infant cares (such as vaccinations) are provided by nurses and pharmacists.
3) Promotional activities are mainly done by public health officers (PH), environmental health officers (EH), and nutritionists (NUT).
4) Other primary care functions are mainly provided by general practitioners (GPs) and dentists (DE).

Second, we identified particular health staff positions that could substitute for the tasks of other health staff. The result of this analysis is presented in Table 4-1, which shows that midwives and nurses especially are most likely to substitute for other functions. These are also the most prevalent positions in CHCs, based on our data source

of 37 local government health profiles in 2011. It is crucial to note that the Indonesian government officially permits the substitution of doctors by midwives but not by nurses (Syah, et al., 2015).[13] Substitution regulations may be different elsewhere.

Table 4-1: Primary health care functions and required

Function	Health staff that is formally assigned to execute these tasks	Health staff that can substitute for the formally assigned staff	
		MW	NU
Primary Health Care	GP, DE	√	
Maternity care	GP, MW		√
Infant & preventive care (vaccination)	PHA, NU		The role of PHA can be substituted by NU
Promotional	EH, PH, NUT	√	√

Explanation of abbreviations: DE (dentist), EH (environmental health officer), GP (general practitioner), MW (midwife), NU (nurse), NUT (nutritionist), PHA (pharmacist), PH (public health officer).

Based on Table 4-1, we expect that substitution patterns are most likely to take place between functional groups. For example, a nurse (from the preventive care group) can substitute a midwife (from the maternity care group). Only with regard to preventive care is the substitution expected to take place within a functional group: the nurse is expected to be able to substitute for the pharmacist, both of whom belong to the same group.

If the substitution mechanism applies, we expect that CHCs with a less diverse mix of skills can reach (equally) high efficacy in all functional domains (primary care, mother and child care, prevention and promotion) compared to CHCs with a more diverse skill mix.

However, there might also be negative consequences of skill-mix substitution for CHC efficacy (as reviewed by Sibbald, et al., 2004; Horrocks, et al., 2002). For example, if nurses perform doctors' tasks, this will likely increase the work demand on nurses, which, in turn, increases their workload and diminishes their ability to fulfil tasks overall (Leverment, et al., 1998). Furthermore, it might lead to uncertainties about responsibilities, which might hamper effectiveness of care (Niezen & Mathijssen, 2014). This implies that skill-mix substitution could also result in less effective health care provision.

Methods

Data sources

Data from 598 CHCs in Indonesia were gathered from two independent sources. The first are health profile reports published by 37 Indonesian local governments in 2011.

[13] An interview between the first author and four CHC directors in the fall of 2016 (?) confirms that this situation has remained: the substitution of physicians by midwives is common practice, particularly in CHC branches or mobile care (source: interview with four directors of CHCs in November 2016).

Compared to other years, 2011 was the year with the most information in terms of the number of CHCs reporting data. The CHC health profiles provide data on: (1) variation of skills in each CHC and the number of health staff who own these skills; (2) data on the output of the CHCs including outcome variables of interest to this study: numbers of vaccinated infants, contraceptive users, promotional activities, and visitors; and 3) general information about the service coverage area of the CHC. including information of interest to this study, such as population size, number of children, number of deliveries in the area, and number of fertile couples. See Table 4-2 for descriptive information about the CHCs.

Analytical method: fuzzy-set qualitative comparative analysis

Qualitative comparative analysis (QCA) is applied. QCA is a method based on set theory and Boolean mathematics. This method is appropriate for our purpose for three reasons. First, it enables formal transparent comparison of CHC outputs in our sample with different combinations of causal conditions—in our case, variations in skill mix. Second, in contrast to inferential correlational methods, QCA allows us to analyze equifinality—i.e., a "situation in which the same outcome may follow from different combinations of causal conditions" (Ragin, 2008; see also Mahoney and Goertz, 2006). This is important for our study given that multiple pathways to high CHC performance are, in principle, possible (Schneider & Wagemann, 2012; Rihoux & Ragin, 2009; Nieto Morales, et al., 2015). Third, QCA provides options to analyze mechanisms of substitution and complementarity (Misangyi & Acharya, 2014).

There are two basic variations of QCA, depending on the level of specification of the variables involved: crisp and fuzzy-set analysis (Ragin, 2008). In this study, we use fuzzy-set analysis (fsQCA), which means that our variables have values between 0 and 1, indicating the degree of membership in a given set or concept. fsQCA is based on the assumption that cases comprise combinations of causals or conditions as well as outcomes, in which the conditions are related to each other. The conditions are part of the subset of outcomes that are theoretically relevant. In this study, this means that skill mix is considered a subset of CHC efficacy. fsQCA analyzes the relation between conditions and outcomes configurationally, by specifying combinations of conditions that relate to a particular outcome (Ragin C. C., 2009; Schneider & Wagemann, 2012; Misangyi & Acharya, 2014).

QCA analysis requires at least two conditions and an outcome variable. Our outcome variable is the CHC output and the causal conditions are the kinds of professions working in a CHC that together form a specific skill mix. We follow three general steps to conduct the fuzzy-set analysis. First, we calibrate the data or define the criteria to categorize the raw data using three analytical anchors: fully-in-membership score, crossover point, and fully-out-of-membership score. Second, we do a truth table analysis to identify sufficient configurations. The truth table shows the possible combinations of conditions (i.e. different skill mixes as represented by different combinations of professions working in a CHC). When a combination consistently

shows itself as a subset of a given outcome, we can perform reduction analysis to identify the set solutions for the entire sample of CHCs (Schneider & Wagemann, 2012).

Operationalization and calibration of set membership

In this section, we operationalize the study variables and report how we calibrated[14] our raw data into set memberships[15] to determine the category of a condition. This is accomplished by determining three qualitative anchors for each set: a fully-in-membership score, maximum indetermination (or crossover) point, and fully-out-of-membership (excluded) score (Schneider & Wagemann, 2012). We used crisp-set calibration for the skills condition (Ragin, 2009) and fuzzy-set calibration for the four efficacy scores as the outcome variables. In the following, we first discuss the operationalization and calibration of the outcome variable and then the set of causals or conditions.

Outcome: efficacy scores for four core functions of CHCs

Health profile reports of CHCs in 2011 were used to calculate efficacy scores, reflecting the capacity of an organization to generate expected outcomes within a given service coverage area (Bohn & Grafton , 2002). We selected relevant available outcomes based on the four basic CHC functions in Indonesia. For maternal and infant care, the measure is the number of deliveries attended by health staff. For preventive care, the measure is the number of vaccinated infants. For promotional activities, the indicator is the number of contraceptive users. For other primary care activities, the measure is visitors for care other than the first three health services in a year.

In calculating the efficacy of CHCs we took into account the health demand in the area (Groenewegen, Heinemann, Greß, & Schäfer, 2015). For example, the number of infants can be assumed to represent the health demand for vaccinated infants. Hence, the efficacy per health care function is defined as the health care service (output) divided by the health care demand in that particular domain. Below we specify the efficacy indicator for each function.

Vaccinated infant efficacy (V): V is the ability of the CHCs to vaccinate the infants in the service coverage area, operationalized as the number of vaccinated infants divided by all infants in the service coverage area.

Attended delivery efficacy (A): A is the ability of the CHCs to attend delivery processes in the service coverage area, operationalized as the number of attended infant deliveries divided by the total number of infant deliveries in the service coverage area.

[14] Calibration is the process of determining whether one condition (or variable) can be included in a category or not (in crisp-set: fully in and fully out, in fuzzy-set; fully in, more in than out, not in and not out, more out than in, fully out).

[15] A set membership is the choice of categories that can be defined based on extant theory or framework used in the research (Schneider & Wagemann, 2012)

Contraceptive user efficacy (C): *C* refers to the number of fertile couples that actively use contraceptive methods in the CHC service coverage area, divided by all fertile couples in the service coverage area.

Other Primary Care Service Efficacy (P): this category consists of visitors that do not fall within the other three categories of health care functions. Thus, P is the number of visitors to the CHC for other than the above three kinds of primary care. We operationalized P as the number of visitors minus the number of patients relating to deliveries (A), vaccination (V) and contraceptive use (C) divided by the population of the service coverage area.

In defining the anchors for calibration of high efficacy of these outputs indicators, we set the fully-in score for each set at the ≥ 3th quartile, the fully-out score at ≤ the median and the crossover point as the median for high efficacy performance (Fiss, 2011). Since the data distribution is skewed to a small number of observations in the 1st quartile and many observations in the 4th quartile, we used the median instead of the mean (Hansen, 2016).

Causal condition: skill mix

The Indonesian government regulation requires a minimum of eight skills (professions) working together in each CHC: doctors, dentists, midwives, nurses, pharmacists, nutritionists, public health officers, and environmental health officers. Interestingly, data on the health staff skill mix in CHCs in 2011 indicate that more than 50% of the CHCs have a skill mix of fewer than eight, and that the skill mix ranged from two to ten different types of staff.

Table 4-2. Calibration and sample descriptives

Variables	Fuzzy-set measure	N	Calibration			Measure descriptive			
			Fully in	Cross-over	Fully out	Median	SD	Max	Min
Outcomes	**Efficacy:**								
	Vaccinated infants (V)	598	100	95	9	95	13.6	100	9.9
	Attended delivery (A)	598	99	93	28	93	12.7	100	28.1
	Contraceptive users efficacy (C)	588	82	77	5	77	17.2	100	5.3
	Other Primary care efficacy(P)	588	85	82	0	82	10.1	97.9	0
Conditions	**Skills:**					Present			Absent
	General Practitioner	598	Present		Absent	572			26
	Dentists	598	Present		Absent	422			176
	Midwives	598	Present		Absent	598			0
	Nurses	598	Present		Absent	598			0
	Pharmacists	598	Present		Absent	471			127
	Nutritionists	598	Present		Absent	351			247
	Public HS	598	Present		Absent	483			115
	Environmental HS	598	Present		Absent	417			181

In addition to the minimum requirement, two additional skills may be present in CHCs: laboratory staff and specialists. Given that we are primarily interested in the skill mix related to the required government standard of eight specific skills, we did not include these additional skills in the QCA. We did, however, explore whether the exemplary cases identified in the QCA shared certain other characteristics, including a specialist and/or laboratory staff.

For the condition variables (skills) we calibrated the data using crisp-set calibration. Since we used fuzzy-set analysis, we defined 0.05 for fully out (absence) and 0.95 for fully-in (present) (Ragin, 2009). Table 4-2 summarizes the full calibration and descriptive data.

Analytical strategy

We conducted four main analyses. First, we used the fsQCA software to run the truth table analysis and second, to run the minimization analysis. Third, we interpreted the various pathways and the resulting core and contributing conditions in terms of substitution and complementarity. Fourth, we studied the exemplary cases of CHCs with high efficacy in our data set to explore qualitatively whether these cases share certain patterns in terms of organizational and contextual variables.

Truth table analysis. We ran a truth table analysis using fsQCA software (Ragin & Davey, 2016). We performed four separate analyses, one for each health outcome. We sought configurations present in at least three CHCs that have a minimum consistency value of 0.8. We used a stringent parameter of fit: a PRI (the proportional reduction in inconsistency) value minimum of 0.75 (Ragin, 2006 in Missangyi et al, 2014; Schneider, et al., 2012). The lower the PRI, the more the identified configuration relates to both the presence and absence of outcomes, whereas we are interested in identifying configurations that relate to high efficacy. The configurations that met a raw consistency score of 0.8 and had a minimum number of cases (3) but did not meet the PRI parameter of fit of 0.75 were categorized as counterfactuals (Ragin, 2006 in Missangyi et al, 2014; Schneider, et al., 2012).

Minimization analysis. From the selected configurations in the truth table analysis, fsQCA 3.0 facilitates the minimization analysis that results in complex, parsimonious and intermediate solutions. These solutions use a minimization algorithm by Quine-McCluskey. The parsimonious solution presents the core conditions related to high efficacy, while the intermediate solution presents not only core conditions but also contributing conditions that lead to high efficacy (Legewie, 2014). Whereas some experts argue that one should only report parsimonious solutions (Baumgartner & Thiem, 2017), we opted to present intermediate solutions instead (which also represent the parsimonious solution through the core conditions). The reason is that we are interested in the combinations of skills that could be both core and contributing conditions to high efficacy, as they could represent mechanisms of substitution and complementarity.

Both parsimonious and intermediate solutions require the inclusion of counterfactual configurations in the analysis since the quality of intermediate solutions depends on explicit theoretical assumptions about such counterfactuals (Legewie, 2014). Therefore, for this analysis, counterfactual configurations that have a PRI value of zero were deleted, because this meant there was no difference in consistency between positive and negated outcomes (also see Schneider 2012, pp.244; Misangyi & Acharya, 2014).

Interpreting the fsQCA results in terms of complementarity and substitution. In addition to listing skills and information on sufficiency, we also related the findings to our hypothetical grouping of skills based on CHC functions (see Table 4-1). This allows to see whether certain types of staff substitute for each other as expected, or complement each other. Substitution means that one *or* another skill is needed for high performance, whereas complementarity means that one *and* another skill is needed for high performance (Misangyi & Acharya, 2014)

We analyzed two types of substitution: 1) within a specific functional group (e.g. doctor substitutes for dentist in the primary care group) and; 2) between functional groups (e.g. between the primary care and maternal care group, as mapped in Table 4-1).

If at least one staff member from each functional group is present, we label this as complementarity across functional groups given that all functional groups are part of a 'recipe' or configuration of CHC high efficacy. If one functional group is not part of the recipe, this might imply that this group is substituted by another functional group. If not all staff members within one functional group are part of the recipe, we assume that this is a sign of substitution, due to overlapping roles and tasks that the remaining staff member has with the absent staff member.

Additional analysis of exemplary cases. We are interested in skill-mix configuration pathways that have high efficacy (above the 3rd quartile). Exploring the exemplary cases in our sample (with a >0.5 consistency score) allows to see whether high efficacy CHCs share specific organizational and contextual characteristics, i.e. whether the CHC has inpatient care, is open 24 hours, and has an ambulance service. We also considered the service coverage characteristics, such as poverty level, remoteness level, and population size.

Results

Table 4-3 presents the configurations of skill mixes found to be sufficient for high CHCs efficacy. In interpreting the solutions throughout our analysis, we sought to understand: (1) the qualitative difference of those skill-mix configurations that result in high CHCs efficacy and (2) how the various skills combine as complementary or substitutive mechanisms.

In the following, we present some general patterns identified in all pathways. In the sections thereafter, we present the analysis per outcome, before we discuss skill-mix substitution and complementarity mechanisms.

Table 4-3. Skill-mix configurations sufficient for high CHC efficacy

Conditions	Vaccinated Infants (V)		Attended Deliveries (A)		Contraceptive users (C)		Other Primary care (P)
	1.a	1.b	2.a	2.b	3.a	3.b	4
Primary care function							
General Practitioners (GP)	■	■	■	■	■	■	■
Dentist (DE)	●	●	●	○	○	○	○
Maternity care function							
Midwives (MW)	■	■	■	■	■	■	■
Preventive function							
Nurses (NU)	■	■	■	■	■	■	■
Pharmacists (PHA)	○	■	●	●	□	●	●
Care promotion function							
Nutritionist (NUT)	○	○	■	■	○	■	■
Public health (PH)	●	○	○	●	●	○	○
Environmental Health (EH)	□	○	○	○	●	○	■
Raw coverage	.13	.12	.15	.13	.14	.13	.14
Unique coverage	.01	.01	.03	.01	.01	.01	.14
Consistency	.97	.98	1	.97	.97	.98	1
Solution coverage		.14		.16		.14	.14
Solution consistency		.96		.97		.96	1

Notes

1. Core conditions are presented by ● (presence) and ○ (absence); contributing conditions by ■ (presence) and □ (absence).
2. The parameter of fit for all high efficacy outcomes categories: raw consistency =.8; PRI consistency =.75; frequency = 3 cases/configuration (analysis with outcomes category V, A, C, P respectively involves 94.31%, 89.13%, 92.68%, and 94.04% of sample).
3. For parsimonious and intermediate analysis, we used the assumption of the presence or absence of the skills based on Table 4-1.

General interpretation

We can draw five general conclusions from the seven pathways presented in Table 4-3, before discussing the pathways to each specific health care output. First, as we expected, multiple pathways lead to high efficacy for various outcomes, except for the 'other primary care' outcome.

Second, the analyses show that CHCs are able to perform well, even though many of them do not meet the required standard of eight skills. Instead, as can be seen in Table 4-3, CHCs with high efficacy scores need five skills to conduct infant vaccination and contraception users' care, and six skills to provide delivery care and other primary care. In other words, the presence of the standard eight skills is not required for high efficacy in these CHCs. Nevertheless, there are no pathways to high efficacy with fewer

than five skills as core or contributing conditions. This indicates that the presence of five to six skills is needed to achieve high efficacy, providing some evidence for our expectation that CHCs with a more diverse skill mix are more effective than CHCs with fewer than five skills in the mix.

Third, Table 4-3 shows that some core conditions unrelated to our expectations contribute to generating particular outcomes. This especially pertains to the presence of dentists as a core condition for infant vaccination and attended deliveries. We will get back to this observation in the following subsections.

Fourth, the results show the importance of the presence of the general practitioner, the midwife and the nurse persistently across all pathways, but as peripheral conditions, not as core conditions. This is interesting since we assumed that these three health professions hold key role in the functioning of CHCs. We will return to this issue at the end of the results section.

Finally, Table 4-3 gives information about the degree to which some positions or skills might be substituted by others. This can be observed in two ways. First, based on the job description analysis (see Table 4-1), we expected that some skills in one functional group (e.g. a GP) can be substituted by a skill in another functional group (e.g. a nurse, as expected for maternity care). We refer to this as the presence of *substitution between functional groups*. Second, skills can also be substituted *within functional groups*, for example, a GP could substitute for the dentist (in the primary care group). However, it might also be that a GP and a dentist are both required (as a core and/or contributing condition), hinting at complementarity within the group. Although we did not make our expectations about these *within group substitution patterns* explicit given that the documentation did not provide information about what to expect about this form of substitution, we will specify both patterns of substitution and complementary – between and within groups – in the following subsections. Table 4-3 summarizes our analyses.

Pathways for high efficacy in preventive care: infant vaccination (V)

The pathway for high efficacy in infant vaccination is presented in pathways 1a and 1b (Table 4-3). We assumed that high vaccination efficacy requires the presence of nurses and pharmacists as core conditions. Based on the job description analysis, it was predicted that nurses can substitute for pharmacists.

Pathway 1a shows that in the absence of a nutritionist and pharmacist, high vaccination efficacy can be achieved through the presence of a dentist and a public health officer as core conditions. Doctors, midwives and nurses are contributing skills. In terms of complementarity, we see that a combination of five skills, either as core or contributing conditions, are related to high efficacy in vaccination. This confirms our expectation that the government standard of eight skills is not a prerequisite for high efficacy in this domain. Nevertheless, we can speak of some form of complementarity because the combined set of five skills (GP, dentist, midwife, nurse and public health officer) relates to high efficacy. Moreover, within each functional group (related to the

four functions of CHC, i.e. primary care, maternity care, preventive care and health care promotion), at least one skill of each group is part of this pathway. This confirms the presence of complementarity. In terms of *within functional group* substitution, we reasoned that nurses could substitute for the pharmacist (see Table 4-1). In this pathway, the pharmacist is not required therefore, we assume that nurses substitute for the role of the pharmacist. Also *within functional group, substitution* can be detected in the promotional group: the nutritionist and environmental health officer seem to be substituted by the public health officer.

Pathway 1b shows that in the absence of all professions in the promotional group, high vaccination efficacy can be achieved through the presence of a dentist as a core condition. Pharmacists, general practitioner, midwives and nurses are contributing conditions. Again, a combination of five skills is related to high efficacy, thereby refuting that the government standard of eight skills is necessary for high efficacy. Nevertheless, the combination of five skills in this pathway indicates the presence of some degree of complementarity. However, contrary to pathway 1a, not all functional groups are part of this pathway, as all skills in the promotional group are absent. Interestingly, both the pharmacist and nurse are part of this pathway, contrary to pathway 1a and what we expected, which suggests that complementarity, and not so much substitution, is important in this pathway.

In both pathways, the presence of a dentist is a core condition. In addition, in pathway 1a, high efficacy can be achieved without a pharmacist if a public health officer is present. In both pathways, general practitioners, midwives and nurses are only contributing and not core conditions for high efficacy, as expected. We could interpret these results as an indicator of task differentiation in CHCs: the presence of a dentist or pharmacist creates less workload for midwives, nurses and general practitioners, so they can better focus on vaccinating children. This can be considered as a form of complementarity: the tasks of specific staff are reduced due to the presence of a dentist. This also makes sense given that reaching high or even 100% immunization coverage for infants in Indonesia requires health staff to travel and reach out to infants in the service coverage area. An alternative explanation could be that when patients come to the CHC for dental problems they are also informed about the possibilities of vaccination by means of billboards or other material in the CHC, leading to a higher output of vaccinated children.

Pathways for high efficacy in mother care: attended deliveries (A)

We assumed that high efficacy in attended deliveries requires the presence of a general practitioner and a midwife. The nurse was expected to be able to substitute for the general practitioner and/or midwife. The results in Table 4-3 show two pathways.

First, *pathway 2a* shows that in the absence of a public health official and an environmental health officer, high efficacy can be achieved if a dentist and pharmacist are present as core conditions. A GP, midwife, nurse and nutritionist are contributing conditions. In terms of complementarity, a combination of six skills is related to high efficacy in attended deliveries, which is closer to the government standard of eight.

Furthermore, this pathway requires the presence of staff in all functional domains, indicating the presence of complementarity. In terms of *between functional groups substitution*, nurses do not substitute for midwives or the GP. On the contrary, a GP, midwife and nurse are all part of this pathway, hinting at complementarity as an important mechanism. The only indicator of substitution is that *within* the group of promotional staff the absence of a public health or environmental health officer requires the presence of a nutritionist.

Second, *pathway 2b* shows that in the absence of a dentist and an environmental health officer, high efficacy can be achieved with the presence of a pharmacist and public health official as core conditions, and with GP, midwife, nurse and nutritionist as contributing skills. Also in this pathway, we can speak of complementarity, since a combination of six skills is related to high efficacy and these skills are spread over all four functional groups. In addition, we see that a GP, midwife and nurse are all contributing factors, providing further evidence for the importance of complementarity in this pathway. In terms of *within group substitution*, it seems that the absence of dentist can be substituted for by the presence of a GP, and the absence of an environmental health officer can be substituted for by the presence of a public health officer and a nutritionist.

Again, the presence of the dentist and the pharmacist as core conditions in these pathways, combined with the presence of GPs, nurses and midwives as contributing factors, can be seen in light of the task differentiation argument made for pathways 1a and 1b.

Pathways for high efficacy in health promotion: contraceptive users (C)

The pathways for high efficacy in contraceptive user care are indicated in pathways 3a and 3b. First, *pathway 3a* shows that in the absence of a dentist and a nutritionist, high efficacy can be achieved through the presence of the public health officer and the environmental health officer as core conditions. The GP, midwife and nurse are contributing conditions. There is evidence of complementarity because a combination of five skills, distributed over all functional groups, is related to high efficacy in contraceptive users. There might be some evidence of the expected *between group substitution* given the required presence of a midwife and the absence of a nutritionist. However, this could also be interpreted as an example of *within group substitution*: the public health and environmental health advisor might substitute for the nutritionist. Other evidence of substitution, although not as expected, is that the GP seems to substitute for the absent dentist and the nurses for the pharmacist. Overall, this pathway requires the presence of at least one type of promotional staff as expected, but also a GP, nurse and midwife, hinting that for high efficacy in contraceptive users there is not much substitution of contraceptive user tasks *between* functional staff groups, but rather *within* groups.

Second, *pathway 3b* shows that in the absence of a dentist and a public health and environmental health officer, high efficacy can be achieved through the presence of a pharmacist as a core condition, with a GP, midwife and nurse as contributing

conditions. There is evidence of complementarity because a combination of five skills is present, distributed over all functional groups. In terms of substitution, there might be some *between group substitution* given the absence of public health and environmental health officers and the presence of a midwife. However, we also see that the nutritionist is a contributing factor, whereas the other two skills in this group are absent, suggesting the presence of *within group substitution*. It seems that the GP can substitute for the dentist. Furthermore, in this pathway, the pharmacist is a core condition, whereas we expected staff in the promotional group to be key (see Table 4-1).

Pathway for high efficacy in providing other primary care (P)

The pathway for high efficacy in providing other primary care is presented in pathway 4. The result in Table 4-3 describes one single pathway: even in the absence of a dentist and public health officers, high efficacy in other primary care activities can be achieved with the presence of a pharmacist as core condition, whereas GPs, midwives, nurses and nutritionist are identified as contributing conditions. There is evidence of complementarity because six skills are distributed over all four functional groups. Moreover, we see hardly any evidence of substitution, in the sense that the GP, midwife and nurses are all part of this pathway. Only the dentist seems to be substituted by a GP as a form of *within group substitution* or a form of *between-group substitution* given that a midwife also needs to be present.

Summary of results

Table 4-4 summarizes our interpretation of the results. In terms of core conditions, pharmacists are important given their presence in five out of seven pathways. Dentists especially seem key to achieving high efficacy in vaccinated infants and attended deliveries. The presence of one or two different health promotion skills is required in six out of seven pathways. GPs, midwives and nurses are contributing conditions in all seven pathways.

We conclude that although there is no pathway to CHC health care efficacy that contains all eight skills required by the government, there is evidence of complementarity, given that in most pathways at least one staff member of one functional group is part of the pathway to high efficacy (except for pathway 1b).

In terms of substitution, we distinguished between *substitution between functional groups* and *substitution within functional groups*. There is little evidence for substitution *between* functional groups. It could be that midwives do (partly) substitute for dentists in the other primary care domain, given that the dentist can be absent if the GP and midwife are present. However, this could also be interpreted as an example of *within group substitution* (given that the GP is part of this pathway). Similarly, it could be that midwives and nurses substitute for the missing skills in the health promotion group regarding contraceptive use (pathways 3a and 3b), but it could also be that the substitution takes place within the promotional group, hinting at *within group substitution.*

Table 4-4. Summary of skill-mix mechanisms

Pathways	Mechanisms between and within functional groups	
	Between functional groups	Within functional groups
Preventive care Pathway 1a	Complementarity: 5 skills in all functional groups	Evidence for substitution in the preventive care group: nurses substitute for pharmacist (expected) the promotional activities group
Pathway 1b	No complementarity/possibility of between functional group substitution: 5 skills in 3 functional groups	No substitution within groups: complementarity except in the absent promotional group
Mother care Pathway 2a	Complementarity: 6 skills in all functional groups Nurses do not substitute for GP or midwife (although expected)	Evidence of substitution within the promotional activities group
Pathway 2b	Complementarity: 6 skills in all functional groups Nurses do not substitute GP or midwife (although expected)	Evidence for substitution within the promotional activities group the primary care group
Health promotion Pathway 3a	Complementarity: 5 skills in all functional groups Midwives and nurses do not substitute for the full promotional group (although expected)	Evidence for substitution within the primary care group the preventive care group the promotional group
Pathway 3b	Complementarity: 5 skills in all functional groups Midwives and nurses do not substitute for the full promotional group (although expected)	Evidence for substitution in the primary care group the promotional group
Other primary care Pathway 4	Complementarity: 6 skills in all functional groups Midwives do not substitute for GPs (although expected) but might substitute for dentists	Evidence for substitution in the primary care group the promotional group
Conclusion	Complementarity between groups in 6 out of 7 pathways	Within group substitution mostly in the promotional activity group: in all pathways the primary care group: 4 out of 7 pathways

Only one of the predicted *within group substitution* patterns was discovered: in pathway 1a, nurses substitute for pharmacists. One unexpected pattern reflects *within group substitution*, especially within the promotional group and partly within the primary care group. It may reflect the fact that nutritionists, public health officers and environmental health officers share overlapping competences, skills and knowledge, which they can use interchangeably. Similarly, a GP can substitute for a dentist, whereas the analysis clearly shows that a dentist does not substitute for a GP.

All in all, there is clear evidence for skill complementarity, quite some evidence for *substitution within functional groups* (but in unexpected ways), and the least evidence for *substitution between functional groups*.

Additional analyses

We did additional analyses to contextualize the above findings. First, we investigated why GPs, midwives and nurses are only contributing conditions while we predicted that their presence would be central since they can substitute for other health staff. The analyses show that GPs, midwives and nurses are substantially present in counterfactual configurations, implying that the presence of these three skills does not ensure high efficacy as such.

Second, we examined the effect of the full skill mix as prescribed by the Indonesian government. The full skill-mix category had a raw coverage of less than.5 with a PRI of.3, while our parameter of fit requires raw coverage of.8 and a PRI of.75. This implies that the solution containing all skills is not a consistent subset of the set of efficacious organizations. This may be due to the high cost of coordinating tasks between this relatively large group of diverse skills (Barr, 1995). Another explanation could be that some skills are not well facilitated in practice, or that there are other qualitative differences not accounted for in our analyses; therefore the contribution of the skills to the overall performance might also be low (Andayasary, 2014).

Third, we tried to identify CHCs that have high efficacy in all outcome categories (by using the Boolean AND in the fsQCA software). However, the analysis did not yield any configuration, meaning that no pathway to high efficacy in all categories that fulfilled the parameter of fit.

Fourth, we delved into the organizational and context characteristics. 29 CHCs achieved robust high efficacy but none of these met high efficacy in more than one category. Only four CHCs in this group did not have additional facilities. Especially the ambulance service seems important: there are 17 CHCs (58% of the high efficacy CHCs) equipped with an ambulance service, especially in the domains of vaccinations and deliveries. This may relate to the use of ambulances to transport health staff to reach places where families with infants or toddlers are living for vaccination purposes, as also confirmed by CHC managers in previous research. Furthermore, ambulances can transport women to CHCs for attended deliveries. Another observation is that all CHCs with high efficacy in other primary health care services have inpatient care units.

We also identified the location of the CHCs with high efficacy. All CHCs with high efficacy in vaccination and attended deliveries are located in non-remote areas. The few cases that are located in remote areas (4) clearly have fewer people living in the service coverage area (ranging from 5,110 to 12,459 inhabitants, compared to the non-remote areas of which the least populated area has 17.789 inhabitants).

As a final step, we explored whether laboratory staff and specialists are prominently present in these exemplary cases. From 598 CHCs only 334 CHCs have laboratory staff. Of the 29 exemplary CHCs, 17 CHCs have laboratory staff; no specific pattern that led to any conclusion. There was no CHC with a specialist in the exemplary cases (and there are only 7 CHCs with a specialist in the full sample).

Table 4-5. Exploring shared CHC characteristics in the seven pathways

Pathway	Raw Consistency	PRI Consistency	Case	24 hours	Beds	Ambulance	Inhabitants	Remote	DR	Midwives	Nurses	Lab
1a	0.99	0.79	121	0	0	1	40947	0	4	16	6	1
Vaccination			135	0	0	1	55237	0	11	19	6	0
			136	0	0	1	84270	0	3	7	7	0
			143	0	0	1	55216	0	1	12	4	0
			486	0	0	0	5770	NA	1	10	7	1
1b	0.97	0.79	30	1	0	0	58323	0	2	10	2	1
Vaccination			130	1	0	1	65946	0	6	15	10	1
			301	0	0	1	6874	NA	1	10	14	1
2a	1	1	42	0	0	1	36837	0	1	8	6	0
Deliveries			257	0	0	1	42220	0	2	17	6	0
			258	0	0	1	28852	0	2	10	4	0
			265	0	0	1	17789	0	2	6	5	0
			269	0	0	1	57790	0	2	22	8	0
			271	0	0	1	45489	0	2	22	8	1
			273	0	0	1	41322	0	2	17	7	0
2b	0.97	0.75	294	0	0	1	6889	NA	2	11	26	1
Deliveries			323	1	0	NA	59050	NA	3	16	17	0
			449	0	0	0	72413	0	2	8	8	0
			527	0	0	0	6545	1	1	27	17	2
3a	0.98	0.8	102	1	1	0	21771	NA	3	13	13	1
Contraception			161	1	0	1	43666	0	1	8	4	1
			336	0	0	NA	61879	NA	1	9	9	0
			511	0	1	1	12459	1	2	9	6	1
3b	0.97	0.75	247	0	0	0	31459	0	1	18	15	1
Contraception			287	0	1	1	14094	NA	2	7	8	1
			551	0	0	0	8303	1	2	11	19	0

Pathway	Raw Consistency	PRI Consistency	Case	24 hours	Beds	Ambulance	Inhabitants	Remote	DR	Midwives	Nurses	Lab
4	1	1	76	0	1	NA	5110	1	3	11	8	0
Other primary care			108	0	1	0	14719	NA	1	10	10	1
			474	1	1	0	23884	NA	3	44	20	2

Note: NA = data not available

Discussion and conclusion

In the CHCs in our sample, the 'standard' skill mix required by the government does not lead to higher efficacy in any of the functional domains. This suggests that a standard skill mix increases coordination costs (Barr, 1995). It could contribute to high quality services, something we did not analyze in this study. The analysis also suggests that as a mechanism, complementarity is important, given that in most pathways require five or six professions in the configuration, furthermore, in most configurations professions from multiple functional groups are core or contributing factors. In terms of substitution, we did observe *within group* substitution especially, and not so much *between-group* substitution, whereas we expected the latter to be more dominant, based on the job profile analysis. We expected nurses and midwives especially to be key in substituting for other staff, but our analyses show that these professions matter 'only' as contributing and not core conditions, meaning that the presence of GPs, midwives and nurses only contributes to high efficacy in combination with other core professions present, such as pharmacists, dentists or particular promotional staff. Even though the analysis did not result in one pathway to overall efficacy, the various pathways generated share similarities to some extent: GPs, nurses and midwives are contributing conditions; dentists, pharmacists and promotional staff are important – albeit in different compositions. Inductive analyses revealed that the presence of additional health facilities, and especially the presence of an ambulance service, might be an important, additional characteristic of the identified high efficacy CHCs.

From the above, we conclude that in our sample various professions in a skill-mix configuration complement each other. Especially if a specialist is present – such as a pharmacist or dentist – this may reduce the workload of the generalist staff (e.g. nurses and GPs). This task differentiation in terms of specialists and generalists seems to be key to achieving high efficacy in certain domains, as shown in our sample. In terms of substitution, we conclude that substituting for staff requires an overlap in tasks and expertise for it to contribute to high efficacy, given that substitution within a functional group is more prominent than substitution between functional groups. Hence, there are limits to substitution in order for it to be effective: our analysis does not confirm the often-used suggestion that nurses can substitute for doctors; on the contrary, in fact.

Various limitations to this study need to be taken into account. First, skill mix is one of many factors that may contribute to CHC efficacy, alongside organization design and context characteristics or management style (Antunes & Moreira, 2013) and the quality of health facilities (Andayasary, 2014). This is apparent in the relatively low unique coverage rates in the analysis. Second, our definition of professions in the skill mix did not include differentiation within a profession, for example, between professional midwives and 'ordinary' midwives, with the professionals having obtained additional certification and thus representing additional knowledge and skills compared to the other midwives (Global Health Workforce Alliance, 2013; Antunes & Moreira, 2013). Third, we focused on efficacy and not quality of care or patient satisfaction. Finally, this empirical study is limited to one case: Indonesian CHCs in the

context of health sector decentralization, in one year (2011) and based on one kind of information (documents).

Despite the above limitations, this study has advanced our understanding of the relation between CHC skill mix and performance by systematically comparing a sample of CHCs in one country, using fsQCA. The results lead to a refinement of the general ideas of complementarity and substitution that are currently used in the literature and debate on skill mix in the health sector: there are various skill-mix pathways to high efficacy in CHCs, related to context and facilities, in which complementarity and substitution mechanisms play different roles. Future studies can build upon this work by applying similar systematic approaches for national or cross-country comparisons, or by comparing private and public health institutions.

FIVE

The Co-production between Community Health Centers and Community Organizations[16]

Abstract

Monitoring the weight of children under five years old is crucial to the early detection of malnutrition. To weigh children in Indonesia's challenging demographic and geographic circumstances requires collaboration between public service and community organizations. This study analyzes the co-production process between professional service and community service organizations and the effect co-production has on the number of children weighed. Community Health Centers (CHC) are key service providers that work closely with community organizations, called *Posyandu*, to weigh children. Building on literature about organization-community relations and co-production of public services, we propose that the number of children being weighed relates positively to the CHC's particular characteristics (e.g. number of midwives, branches and promotion activities) and the number and type of *Posyandu* that co-produce the service. We distinguish between *Posyandu* that are organizationally strong, intermediate and weak. We also expect a positive interaction effect between CHC characteristics and strong *Posyandu*. We compiled an archival data set from 37 local government reports on CHC profiles that were published in 2011 and applied negative binomial regression analyses to test our hypotheses. Unexpectedly, we find that weak and intermediate *Posyandu* matter especially for the number of weighed children. We ascribe this to the cost of using the services of strong *Posyandu* as well as to the close control of weak and intermediate *Posyandu* by the state and CHCs.

Keywords: Co-production, Organization – Community Relations, Community Health Centres, *Posyandu*, Indonesia

[16] This chapter is co-authored with Rafael Wittek, Mark Huisman, and Liesbet Heyse.

Introduction

Proper nutrition in early childhood (under five years old) is critically important to ensure a child's healthy growth, cognitive ability, and physical development. Improper infant nutrition may cause three nutritional problems: (1) Stunting (or remaining too short) compared to others of the same age, (2) underweight and wasting (or too thin), and (3) overweight. In addition to affecting children's future well-being, nutrition-related problems can lead to high cost for health care since malnutrition is associated with vulnerability to diseases, a low immune system and even death (Liu, et al., 2012).

Overcoming malnutrition has become a national health objective in Indonesia and many other developing countries since the late 1980s (Elfindri & Dasvarma, 1996). In 1984, the problem of malnutrition in Indonesia was recognized, following a national survey conducted in 1978. Ever since, the government has funded and implemented programs to address malnutrition. In 1988, through poverty alleviation programs implemented by UNICEF, malnutrition was reduced by 10%. This was claimed to be the cause of better socio-economic conditions of the community (Elfindri & Dasvarma, 1996). However, the problem of malnutrition continues. In 2007, some 36.8% Indonesian children were stunted, whereas in 2013 the stunting rate was 37% (Rachmi, et al., 2016). Moreover, about seven million Indonesian children have never been weighed (The Ministry of Health, Indonesia, 2013). This shows that addressing stunting in children is not an easy task and requires intensive, continuous attention (Ministry of Health Republic of Indonesia, 2016).

Current research on Indonesia explains children's nutritional status by community, family and individual conditions such as the education and income of parents (Bernardus, et al., 2015; Rarastiti & Syauqy, 2014; Hanandita & Tampubolon, 2015; Roemling & Qaim, 2013), the weighing frequency of infants (Anwar, et al., 2010; Rarastiti & Syauqy, 2014), food consumption and expenditure on nutrition (Roemling & Qaim, 2013; Rarastiti & Syauqy, 2014), and spatial, poverty and family characteristics (i.e. number of children, head of the household) (Hanandita & Tampubolon, 2015; Roemling & Qaim, 2013). These studies yield valuable knowledge about malnutrition causes at the individual, household and community level. However, in the past decade, many governments have begun emphasizing the importance of making clients central in health care provision (Brandsen & Honingh, 2015) as part of political decisions to decentralize service provision by the state. It is believed that including clients in the service delivery process will result in better service provision (Handajani, et al., 2009; Bovaird, 2007; Huxham, et al., 2000). In order to assess the validity of these assumptions, a new perspective on studying health care services has emerged: health care provision as a co-production (Batalden, et al., 2016). Co-production is defined as the provision of services through collaboration between public agencies and citizens (Brandsen & Honingh, 2015). Interestingly, little research has been done into the question how co-production to fight malnutrition is achieved and what its effect is

(Subramony, 2017).[17] Especially the collaboration between public health institutions and local community organizations (Subramony, 2017) in battling malnutrition remains understudied, even though public service organizations can only be successful agents of change in communities in close collaboration with these communities. This study aims to address this gap in research for the Indonesian case by focusing on the collaboration between community and health service organizations and its impact on the number of children weighed to monitor their nutritional status.

Malnutrition is a highly challenging problem to address – also in Indonesia – since it relates to a wide range of aspects such as family characteristics (e.g., parents' educational background) as well as the wider context, such as the remoteness of areas which makes health services difficult to access (Hanandita & Tampubolon, 2015; Roemling & Qaim, 2013). Therefore, Community Health Centers (CHCs), the health institution closest to the community, have been assigned the task to monitor the nutritional status of infants, through regularly weighing them. Regular monitoring can detect cases of malnutrition early and the CHC can take action to address it. CHCs are sometimes assisted in this task by *Posyandu:* voluntary, community-based organizations at the neighborhood level whose goal is health care delivery, including infant weighing. Despite the co-production between *Posyandu* and CHCs, only two-thirds of Indonesian infants and children are weighed nationally (The Ministry of Health, Indonesia, 2013).

This study aims to analyze the relationship between both CHC and *Posyandu* characteristics and their collective performance in weighing children and infants under five years old. The main research question is if and to what extent variation in the characteristics of CHCs and *Posyandu*, individually and interactively, explains the variation in the number of weighed infants and children in CHC service coverage areas in Indonesia. Using an archival data set compiled from 37 local government reports on health CHC profiles that were published in 2011, we build upon recent literature on service organization-community relations (Ostrom, et al., 2015; Subramony, 2017; Bovaird, 2007; Kelley, et al., 1990; Brandsen & Pestoff, 2006) and service co-production that stresses the importance of service organization-community co-production for successful service provision (Brandsen & Honingh, 2015; Pestoff, 2006). Based on this literature, we derive three conditions for successful co-production – related to the kind of CHC staff involved, the role of training, and options to adjust the organizational structure to reach communities – and use these to formulate a set of hypotheses tailored to the Indonesian system of community health centers and organizations (Anwar, et al., 2010). Specifically, we hypothesize that in order for CHCs to be successful in weighing infants collaboratively, certain characteristics are favorable, namely the number of midwives, CHC branches and promotion activities. We study whether the number and type of *Posyandu* present in a CHC service area contribute to raise the number of weighed infants and children, in addition to CHC characteristics.

[17] Subramony claims that only 2% of malnutrition studies focus on the community level.

Our research contributes to the literature on service organization-community relations and co-production as well as studies in organizational endeavors to detect malnutrition cases early. First, we extend current insights in the literature on service organization-community relations and co-production. This literature ranges from a focus on co-production by individual members of communities (see Subramony, 2017) to co-production by community organizations coming together for collective action: community service organizations (CSOs). The assumption is that co-production by the collective action of community members would contribute to viable and sustainable social service co-production since collective actions facilitate the development of social interaction, social capital, reciprocity, and mutualism between involved individuals (Pestoff, 2014).

Second, previous research on service organization-community relations is predominantly qualitative in nature (Voorberg, et al., 2015). These studies often do not study the impact of co-production (Ostrom, et al., 2015), including service-user outcomes and well-being (Anderson, et al., 2013). Our study applies a quantitative explanatory approach, studying how co-production between CHCs and *Posyandu* relates to the percentage of children under five years old having been weighed in the year 2011.

The structure of the rest of the paper is as follows. We first describe the characteristics of CHCs and *Posyandu*, to understand the organizational arrangements of co-production in health services at the local level in Indonesia. In the next section, we discuss the theoretical implications of the service organization-community relations perspective in light of the Indonesian context and formulate a set of hypotheses. Further, we define the data collection and analysis methods we use to test the hypotheses. Finally, we present the results, followed by the discussion and conclusion.

Indonesian Community Health Centers and *Posyandu*

CHCs are government organizations at the sub-district level in the Indonesian primary health care system. In 2011, there were 9321 CHCs providing primary health care services, spread over 7024 sub-districts all over Indonesia (Badan Pusat Statistik, 2016). The establishment of CHCs follows national criteria defined by the Ministry of Health: a CHC covers from 30,000 to 50,000 people except in remote areas and is assigned the health institution closest to the community for universal access to affordable health care for all levels of the community. CHCs act as the first health service institution that the community can visit when they have health problems (WHO, Regional Office for South-East Asia, 2017). CHCs have four basic functions, primary care provision, infant and mother care, preventive care, and promoting health care. Midwives are the prime professionals responsible for mother and infant care, and thus for weighing infants and children.

In 1998, to reduce the infant and mother mortality rate, the government started the ‘village midwife’ program that aimed to distribute midwives evenly across

Indonesia, with one midwife per village (Triyana, 2016; Shankar, et al., 2008). This was to assure the availability of adequate and immediate health care for infants and mothers in remote areas to enable intensive interaction between professional health staff and users in the community (Shankar, et al., 2008). Through the village midwife, health care programs and information on healthy life styles can easily spread to the community level, particularly to women as the specific patients of midwives. Village midwives also are responsible for providing coaching to community organizations, the *Posyandu* (Triyana, 2016). Midwives thus have an important bridging function between CHCs and *Posyandu.*

Besides conducting mother and infant care (through the presence of village midwives), CHCs also implement promotion campaigns on health to the communities. Promotion campaigns correspond to the design of national programs but are adjusted to the local context and community health needs. The promotion aims to enhance the community's knowledge on health, to improve community awareness and user participation in the services, and to visit the *Posyandu* to regularly weigh infants and children under five years old. To achieve these aims, promotion includes disseminating information to the community on healthy lifestyles, diseases, how to anticipate or prevent diseases, including information about other CHC programs. Promotion activities also include monitoring of the health environment in households and communities (Ministry of Health, the Republic of Indonesia, 2007).

To improve access to communities, CHCs can have branches at the village or sub-sub district level (MoH Decree 128/2004). Placing a branch in a village means that health staff and health instruments are close to the community. This is expected to enable CHCs to recognize local health problems and necessities in time, and to take further take action if needed (World Bank, 2016).

Posyandu is a community-based organization at the neighborhood level run by cadres[18], or volunteers. *Posyandu* were initiated in 1986 by Ibu Tien Suharto, then the first lady of the Republic of Indonesia, as an effort to empower women and increase their participation in the health care sector. The success of *Posyandu* in the early years of its development leveraged the establishment of more *Posyandu* in all regions in Indonesia, officially encouraged by the Ministry of Home Affairs.

The term *Posyandu* stands for *Pos Pelayanan Terpadu*, or integrated service post, and is historically the place where the community can access several government-run health care programs. *Posyandu* can cover five programs: (a) infant weighing, (b) provision of consultation on contraception, (c) providing information about and supplying ng nutritional supplements, such as high-concentrate vitamin A for infants every February and October and iron tablets for pregnant women, (d) immunization[19], and (e) diarrhea-prevention measures (The Ministry of Health, 2011).

[18] Cadres are community members who are willing, able and have the time to voluntarily conduct *Posyandu* activities (Ministry of Home Affair's Decree No. 19, 2011).
[19] Immunization by cadres is done via medicine administered orally (drops) to the infant, not by injection.

The Indonesian monetary crisis in 1997, alongside increasing expectations of the potential of *Posyandu* to contribute to the community, led to the enactment of a new decree in 2001 (no 411.3/1116/SJ year 2001) by the Ministry of Home Affairs. The decree facilitated the revitalization of *Posyandu* by giving them the authority to provide additional services besides health sector services, for example, offering education to the under-fives and facilitating economic activities to help improve the economic condition of its members' families.

As an independent organization, each *Posyandu* defines and implements its own program. However, national regulations require that when performing their health care tasks, *Posyandu* should involve at least one member of the CHC health staff. In addition, *Posyandu* also require access to other CHC resources, such as vaccines, a weighing scale, a sphygmomanometer (blood pressure measurement device), contraceptive pills and condoms for demonstrations (The Ministry of Health, 2011). Therefore, interaction between *Posyandu* and CHC health staff is mandatory.

There are four categories of *Posyandu* according to the MoH (see Table 5-1; Figure 5-1 depicts the formal institutional relations between CHCs and their *Posyandu*).[20] *Posyandu* differs in terms of their *human resource base* (number and stability of cadres, i.e. members who have received training from CHC staff), *scope* (frequency of activities, span of program coverage, number and type of activities implemented, member coverage (i.e. the proportion of cadres per number of households*)*, and *autonomy* (whether or not the *Posyandu* are allowed to collect funds from community members in order to finance their activities (Ministry of Health, 2009), and the degree of oversight they receive from MoH and CHC staff).[21]

Table 5-1 The characteristics of the four categories of Posyandu

Category	Human Resource		Scope			Autonomy	
	Stability of cadres	Cadres	activities per year	Program coverage	Member coverage	Collect funds	Oversight by CHC
Pratama	X	<5	<8	X	X	X	high
Madya	√	>5	>8	< 3	< 50%	X	moderate
Purnama	√	>5	>8	> 3	< 50%	X	moderate
Mandiri	√	>5	>8	5 +	> 50%	√	low

Depending on their size, scope, and autonomy, the four types of *Posyandu* can be ordered on a continuum of organizational strength or "completeness" (Brunsson & Sahlin Andersson, 2000). The high end of this continuum (strong human resource base, wide scope and autonomy) is represented by the independent, well-staffed *Posyandu*

[20] We summarized the information from various sources**.**

[21] Only *Posyandu Mandiri* can collect funds, according to the *Posyandu* training book (The Ministry of Health, 2011). These funds can be money or goods (also food) that can be transformed to cash, or assets (i.e. a place or land to build a health post). The *Posyandu* activists together with the members define the amount of money or what kind of goods each member can contribute, and how these funds will be used. This might mean that not all members are obliged to contribute, or only a very small sum or amount. Generally, *Posyandu*s collect little funds (Dewi, 2011).

Mandiri, with their wide-ranging program coverage and their right to charge fees and subsequently allocate these funds independently, according to their own objectives.

The low end of the continuum (weak human resource base, narrow scope and autonomy) is represented by the strongly controlled *Posyandu Pratama* with their relatively limited program coverage, and small and fluctuating staff base. Their activities are irregular and under close control of the government; they are not allowed to charge fees for their services. Their members require intensive training and communication with CHC health staff, in order to enhance the cadres' basic knowledge of health and to create awareness of the importance to co-produce health services.

In between these two extremes (intermediate human resource base, scope and autonomy) are the *Posyandu Madya* and *Posyandu Purnama*. The only difference between them is in program coverage. *Madya* covers a maximum of two programs while *Purnama* covers at least three. These two types of *Posyandu* still require training from CHC health staff to enhance their knowledge on health as well as their capacity to increase program coverage.

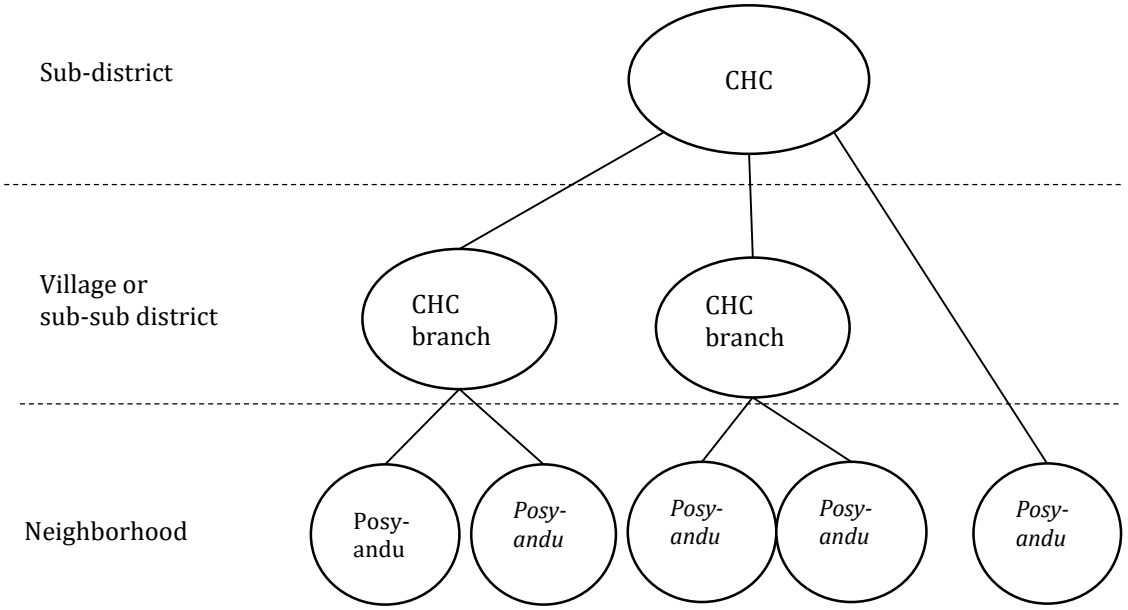

Figure 5-1 CHC-Posyandu position based on administrative level

Theoretical background

The literature on service organization-community relations highlights the role of communities in influencing, receiving, and co-creating public services as a way to improve the effectivity of service performance responsive to the community or service users. This broad literature ranges from a focus on collaboration, co-production, or corporate social responsibility to studies on the impact of community characteristics on the success of service-provision organizations (Bovaird, 2007), and more broadly on

society and community well-being (Anderson, et al., 2013) and future social needs (Ostrom, et al., 2015).

We build on research on human resource approaches that stimulate community co-production among staff in service organizations (Subramony, 2017), which suggests that co-production yields good results if three conditions are in place. First, appointing employees with a specific external community focus enables active engagement with the community (Caligiuri, et al., 2013; Brickson, 2007). Second, the presence of intra-organizational sub-communities, which may contain both professionals and community members (e.g. communities of practice[22]) is suggested so that these groups can share knowledge to successfully address challenges relating to the co-production of services (Pyrko, et al., 2016; King, et al., 2011). Third, if there is regular training and socializing, it is important that staff exchange knowledge, information, and experiences (Subramony, 2017; Triyana, 2016).

In what follows, we connect the above three conditions to the specific characteristics of CHCs and *Posyandu* to understand the effect that CHCs and *Posyandu*, both individually and interactively, have on the number of weighed infants and children in Indonesia. In order to do so, we reviewed government regulations on the functioning of CHCs and *Posyandu* to describe the institutional arrangements of these two organizations. Based on this review, we concluded that the first condition of having staff with an external focus also holds for CHCs, but that the second and third conditions (related to training and internal sub-communities) need to be adapted by adding inter-organizational dimensions, with CHCs as focal organizations and the *Posyandu* as their partners.

Community Health Centers as core public service provider

According to formal regulations, CHCs are responsible for providing primary health care to communities and maintaining and improving the public health status in their service coverage area (WHO, Regional Office for South-East Asia, 2017). Each CHC has to meet a minimum performance target, which is individually set by the Departments of Health in each district. Each CHC has to report its performance to higher-level institutions, such as the Department of Health and the MoH.

The success of these organizations depends on the degree and nature of co-production with the actors in the community to encourage the use of health services (Subramony, 2017; Bovaird, 2007). Meanwhile, the community-based *Posyandu* does not have a formal obligation to other institutions, making their input slightly unpredictable (Bovaird, 2007; Joost , et al., 2015).

Based on their formal, government-assigned tasks and obligations, we assume that CHCs will invest in their own capacity in order to meet their assigned goals, including weighing infants and children, also because they cannot formally count on

[22] Communities of practice refers to groups of individuals who have the same interest in specific issues or problems, and interact intensively to share their experience and learn from each other (Wensing, et al., 2002).

Posyandu to contribute, as these do not have a formal obligation to help co-produce these services. The CHC's investment in capacity, to achieve the assigned goals, shows similarities with the three conditions for successful community co-production in the human resources approach to service organization-community relations.

Staff with an external community focus

First, CHCs have – as mentioned – the midwife program that positions midwives (one per village) to practice and live with the community. Hence, this midwife does not work in the CHC office, but lives in the community and works from her home or a fairly small post that is provided by the government or the community. This represents the availability of organizational staff with an external community focus mentioned earlier. Having such staff not only facilitates effective co-production but also benefits the staff: working closely with communities makes staff feel fulfilled, which benefits their job satisfaction and individual performance (Brickson, 2007; Glavas & Ken, 2014). Given that the presence of village midwives facilitates the villagers' access to the infant-weighing service in the village, we hypothesize that the number of midwives in a CHC relates positively to the number of weighed infants and children (H1a).

Presence of an organizational unit that brings staff and community together

Second, the presence of intra-organizational sub-communities, which may consist of both professionals and community members is suggested (e.g., communities of practice[23]), so that these groups can exchange knowledge to successfully address challenges relating to the co-production of services (Pyrko, et al., 2016; King, et al., 2011). There are no such communities in Indonesian CHCs, but there is an equivalent close to this concept: the CHC branches, sub-units established to place CHC health staff geographically closer to the community. CHCs may recruit temporary health staff in the surrounding areas or villages to work in the branch location (information gathered through two CHC directors, in a remote area in Central Lombok District, November 2016). In this way, CHC branches facilitate both knowledge sharing and coordination of tasks between community members and CHCs (King, et al., 2011). This not only makes primary health care more accessible to local communities since patients do not have to travel that far, but the interaction between health staffs and community members is more regular and visible. This also enables health staff to approach and interact easily with community members and provide them information to participate actively in health care programs, including weighing children. Thus, we hypothesize that the higher the number of CHC branches, the higher the number of weighed children will be (H1b).

[23] Communities of practice refers to groups of individuals who have the same interest in specific issues or problems, and interact intensively to share their experience and to learn from each other (Wensing, et al., 2002)

The importance of training and socializing

Third, an important precondition is the availability of regular training and socializing so that staff can exchange knowledge, information, and experiences (Subramony, 2017). Providing regular training and socialization opportunities for the community is key to successfully co-producing the service and helping other community members find and use the service correctly (Kelley, et al., 1990; Rosenbaum & Smallwood, 2013). For the Indonesian setting, we assume that the CHC promotion campaigns on healthy life style, disease prevention, and information on government programs would fulfill this requirement. We expect that these activities encourage community members to access CHC services and participate in health programs, including weighing infants and children. This leads to our hypothesis that the higher the frequency of promotion activities, the higher the number of weighed children will be (H1c).

Posyandu as community service providers

With the greatest organizational strength, the *Posyandu Mandiri* can provide several health services and can thus contribute to improved health in a community. First, the presence of this CSO eases the access to services (Kelly, et al., 2016), including weighing infants and children. Second, since *Posyandu* cadres are community members, they have social connections to other members. Their social influence in convincing others to use the service may lead to high numbers of recipients, which not only benefits service effectiveness and efficiency (Rosenbaum & Smallwood, 2013), but also the quality and sustainability of social services (Verschuere, et al., 2012; Pestoff, 2014). Specifically, in our study, we expect that this co-production will positively motivate mothers to bring their children to be weighed.

The *Posyandu Mandiri* is particularly expected to provide health services successfully, given that their independence in planning, financing and implementing activities as mandated in Ministry of Home Affairs Decree enacted in 2001 and 2011.[24] Given the maturity and independence of this particular type of *Posyandu*, we assume that their skills and knowledge can be transferred from cadre to cadre, and that they depend less on CHC health staff. They can also become the main service provider in weighing infants and children because the cadres can use their personal connections to encourage community members to attend the weighing. Thus, we hypothesize that the higher the number of *Posyandu Mandiri* in a service coverage area, the higher the number of weighed infants and children (H2).

[24] The Decree of Minister of Home Affairs on *Posyandu* Revitalization no. 19 year 2011; the previous regulation on the same subject was enacted in 2001. Their expected contribution and operationalization are stated in the general guidance from the Ministry of Health which is freely downloadable from the website of the Ministry of Health)

Community co-production: *Posyandu Mandiri*– Community Health Centers interaction

The relation between public service organizations and communities is assumed to relate positively with the use of services by communities (Subramony, 2017) since the involvement of both creates added value to service delivery. To facilitate co-production, the public service organization (here: the CHC) is required to engage in knowledge exchange and coordinate the provision of information to the CSO. These interactions are expected to motivate and facilitate the CSO to co-produce good quality service delivery (Pestoff, 2014). Thus, we expect that the presence of especially a *Posyandu Mandiri*, due to its organizational strength, will reinforce the expected positive effects of the three CHC conditions on the number of weighed infants and children.

First, a midwife in a village can facilitate direct regular contact with the *Posyandu* cadres and this CHC representative. The midwife can help train the cadres, provide information and help with the weighing (Triyana, 2016). Therefore, we expect a positive interaction between the number of midwives and the number of *Posyandu Mandiri*. Second, the presence of a CHC branch indicates the regular presence of CHC staff, who facilitate easy, direct and regular contact between CHC and the well-trained *Posyandu Mandiri* cadres, as well as between CHCs and the community. This may intensify the knowledge exchange from the CHCs to the community as a whole, not only with the mothers. Hence, the presence of a CHC branch might ease the assistance of CHC staff in *Posyandu Mandiri*'s monthly services and that may increase the number of visitors, since they can have quick service during the *Posyandu* activities. Third, the CHCs' promotion activities may enhance community knowledge and strengthen *Posyandu* information exchange. We therefore hypothesize a positive interaction between each CHC characteristic and the number of *Posyandu Mandiri* in relation to the number of weighed infants and children (H3). Figure 5-2 summarizes our conceptual model.

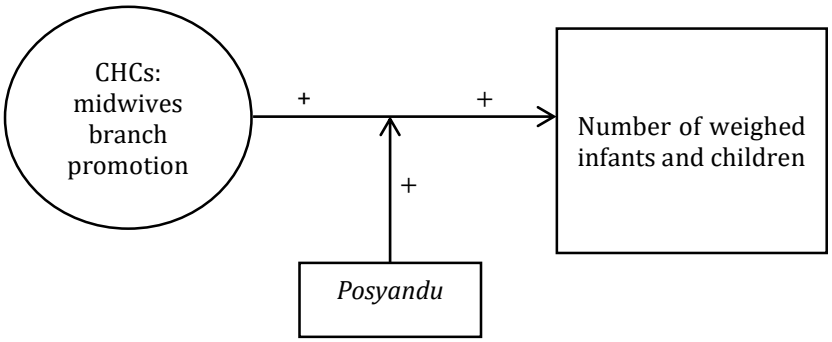

Figure 5-2 Theoretical framework

Methods

Data Sources

Data on CHC health performance in Indonesia is hard to find because of the wide geographical dispersion of CHCs and the under-developed infrastructure of information management systems in the Indonesian health sector. This study is therefore based on a relatively small sample of 598 CHCs in 2011 (then 6.4% of the total number of CHCs). We combined two data sources to create this sample. The year 2011 was chosen because, at the time of data collection, it was the most recent year for which most information in these two data sources was available.

First, we retrieved CHC data of 2011 published on the MoH's official website[25] that includes the characteristics of the service coverage area in terms of remoteness level. Second, this information was combined with data retrieved from 37 district health profile reports of each district in 2011, published by the Department of Health (DoH). Some reports were accessible from the official MoH website, others from district websites. These reports present information per CHC. The MoH arranges and coordinates data collection through the DoH in each district. The Ministry determined the collection instruments, indicators, and report structure to ensure the necessary level of uniformity required for aggregating information to the Province and National levels.

The health profile report has three parts. First, it describes the context of the region; for example, population size, number of poor people, number of infants and children under five, and number of *Posyandu* per type in the area. Second, it provides information about health care services and community health conditions, such as the number of weighed infants and children, and the frequency of promotion activities. Third, it provides information about each CHC, for example, its number of branches and number of midwives.

Since 2005 Districts have been expected to provide a health profile report on a yearly basis. However, not all districts comply, and only a small fraction of them publishes the report on their websites. Therefore, the number of available reports is limited. The reasons why some CHCs do and others do not publish a health report are not known, but it might have to do with the lack of capacity to create such a report.

Our analysis focuses on 2011, the year for which most health profile reports were published (47 with information about 735 CHCs). 37 districts (with information about 598 CHCs) provided complete data required for the present study.

[25] For example, the Kabupaten Tangerang health profile can be downloaded here: http://www.pusdatin.kemkes.go.id/resources/download/profil/PROFIL_KAB_KOTA_2011/P.Banten_Kab.TANGGERANG_11.pdf accessed on April 27th 2017

Variables and measurement

The dependent variable in this study is the number of weighed infants and children in the CHCs service coverage area. We gained this information from the district's health profile reports 2011.

We have two groups of independent variables; one group relates to the CHC as a public service organization, which includes three indicators. First, the presence of employees that focus on the community is represented as "midwives" (i.e. the number of midwives in the CHCs). Village midwives are usually CHC midwives, but the number of midwives in a CHC is not always equal to the number of villages (Interview with CHC directors in four locations on November 3-5, 2016). Some CHCs have more midwives than villages, with some midwives fulfilling administrative or other tasks in the CHC. In some cases, primarily in remote areas, there may be fewer midwives than villages. In this case, one midwife may provide services to more than one village. Second, the presence of CHC branches is the number of branches a CHC has in its service coverage area. Third, the CHC effort to share knowledge on health to the community, "promotion activities", is the frequency of CHC promotion activities in a year (2011).

The second variable group refers to the role of *Posyandu* as community-based organizations. As described in Table 4-1, we distinguish three types: the *Posyandu* with greatest organizational strength (*Posyandu Mandiri*), the *Posyandu* with intermediate organizational strength (*Posyandu Madya* and *Purnama*) and the *Posyandu* with least organizational strength. For the sake of convenience, we label these three types of *Posyandu* as 'strong', 'intermediate' and 'weak'. As outlined above, the strong *Posyandu* is our independent variable because this type has the most organizational strength in terms of human resources, scope and autonomy. Hence, we expect this type to provide infant-weighing services most regularly and effectively. We operationalized this measure as the number of strong *Posyandu* in the CHC service coverage area.

We include three control variables in the analysis: the number of weak *Posyandu*, the number of intermediate *Posyandu*, the poverty rate, and the remoteness of the service coverage area. We set the poverty rate as a control variable, since infant nutrition is associated with poverty (Hanandita & Tampubolon, 2015; Roemling & Qaim, 2013). The data source for the poverty rate is the local governments' health profiles. The MoH defined 'poverty rate' based on data from the national demographic survey.[26] Remoteness also diminishes infants' nutritional status (Hanandita & Tampubolon, 2015). The MoH defines three categories of remoteness: normal or non-remote, remote and very remote areas.[27] In our data, we combined remote and very

[26] Data on poverty in the health profile is based on the Social Economic and Demographic Survey 2010. Poverty was measured by Central Bureau of Statistics (CBS) Indonesia using an indicator based on the basic needs approach.

[27] The remoteness level is defined by the regulation of the health minister (Starfield, et al., 2005). Remote area is characterized by three indicators: (1) geographic position: difficult to access, disaster-prone, in mountainous area, inland, and swamp area; (2) public transportation facility: available maximum twice a week, required travelling time (return) 6 hours maximum; (3) social economic condition: lack of staple goods, insecure or conflict area. The very remote area is characterized the same as remote with these additions: (1) geographic position: tiny island, in outer or border area of the country; (2) public transport: no routine public

remote areas in one category 'remote area', because we have only two CHCs that are categorized as being in a very remote area. We coded the remote area as 1 and non-remote area as 0.

The numbers of weak and intermediate *Posyandu are* included as control variables, because even if they do not co-produce weighing services optimally, they may still contribute to the service.

Method of analysis

We used negative binomial regression analysis because the dependent variable is count data and therefore not normally distributed. Negative binomial regression removes bias resulting from over-dispersed count data, which is the case here (Greene, 2003). Prior to this, we did collinearity analyses between independent variables to avoid bias in the results.

Analytical strategy

We did our analysis in two main steps. First, we tested the hypotheses for all observations in our data, with remoteness as a dummy variable (Pallant, 2013). Second, because there is high multicollinearity between poverty and remoteness, we did additional analyses by splitting the data into two data sets; remote and non-remote.

In both steps, three Models were estimated: Model 1 contains the control variables only; Model 2, adds the main effects; Model 3 adds interaction effects. To address collinearity between independent variables, we centered the main effect variables (Jaccard & Turrisi, 2003). Outliers were excluded from the analyses, based on box plots (1.5 times inter quartile range above the third quartile or below the first quartile). For reasons of transparency, we also report the results of Model 3 for the sample that includes the outliers.

Results

Descriptive and regression results on overall data

Table 5-2 presents a description of dependent and independent variables per CHC service coverage area. Of the original 598 CHC service coverage areas, information about 329 areas remain after list-wise deletion.

Table 5-2 shows that on average, a CHC is related to two to three strong *Posyandu*. However, not all CHC coverage areas have strong *Posyandu*. Midwives are consistently present in every CHC coverage area, whereas CHC branches are absent in some CHCs. Some CHCs do no promotion. The variable with the most missing data is remoteness; this information is only available for 420 CHCs of which 320 are located in non-remote areas and 100 are located in remote areas.

transport or none within the area, the area can only be accessed by plane, the service may be cancelled because of climate or waves; (3) the same social economic condition criteria as the remote area.

Table 5-2 Description of the complete data

Variable (all data is available for 2011)	Observations	Mean	SD	Min	Max
The number of weighed infants and children under five	587	1877.6	1500	64	13.08
Number of midwives	598	13.78	9.63	1	66
Number of CHC branches	552	2.86	2.10	0	18
Number of promotion activities	541	32.23	91.16	0	805
The number of ' strong' *Posyandu* (*Mandiri*)	569	2.54	4.82	0	24
The number of infant and children under five	587	2620.33	1819.23	157	16311
The number of 'intermediate' *Posyandu* (*Madya* and *Purnama*)	569	25.28	18.72	0	95
The number of 'weak' *Posyandu* (*Pratama*)	569	6.77	11.61	0	77
Poverty rate (%)	549	41.17	20.54	4.14	100
Level of remoteness (dummy)			Freq	(%)	Cum
Non-remote (0)			320	76.19	76.19
Remote (1)			100	23.81	100
Remote total	420			100	
List wise	329				

Table 5-3 reveals a high correlation between remoteness and poverty (>0.5). As outlined in the analytical method, we took this collinearity problem into account by means of two strategies: (1) conducting an analysis with remoteness as a dummy variable and (2)splitting the data into remote and non-remote areas and then conducting the analysis.

Table 5-3 Correlation between independent variables of the complete data

	Variables	1	2	3	4	5	6	7	8	9
1	Midwives	1								
2	Branch	.136	1							
3	Promotion	-.078	.094	1						
4	Strong *Posyandu*	-.008	-.057	-.079	1					
5	Children under five	.043	.064	.076	.122	1				
6	Intermediate *Posyandu*	.241	.119	.141	.107	.462	1			
7	Weak *Posyandu*	-.127	.115	-.012	-.165	.208	-.274	1		
8	Poverty	.063	.236	-.071	-.088	-.247	-.168	.305	1	
9	Remote	.286	.182	-.154	-.266	-.395	-.333	.014	.511	1

The results of the negative binomial analysis are presented in Table 5-4. It contains three Models. Model 1 tested the control variables: the number of weak and

intermediate *Posyandu*, the poverty rate, and the remoteness level. Model 2 adds the CHC and strong *Posyandu* variables. Model 3 adds the interaction effect of the three CHC characteristics with the number of strong *Posyandu*. We also present Model 3 of the analyses that includes the outliers.

We take Model 3 in Table 5-4 to discuss our findings. All control variables have a significant relationship with the dependent variable. Hence, the number of children under five that have been weighed increases with the number of under-fives in a CHC service coverage area and the number of weak and intermediate *Posyandu* in the area. Remoteness and poverty are significantly negatively related to the dependent variable in all Models. Thus, in remote and poor areas, fewer children are being weighed. To illustrate this, the estimated co-efficient of poverty rate of -0.004 means that with an increase in poverty rate of, for example, 20%, the number of weighed children decreases by 8%.[28]

Table 5-4 Negative Binomial regression analysis on all observations

Variables	Model 1 N = 362		Model 2 N= 329		Model 3 N=329		Model 3 incl. outliers N=338	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
CHC midwives			.000	.002	-.001	.002	.000	.002
CHC branches			-.022*	.012	-.019	.012	-.019	.012
CHC promotion			.000	.000	.000	.000	.000	.000
Strong *Posyandu*			-.008**	.004	-.009**	.004	-.002	.002
CHC mid*Strong Pos					.000	.000	.000***	.000
CHC bran*Strong Pos					-.004	.002	-.000**	.000
CHC prom*Strong Pos					.000*	.000	.000**	.000
Under-fives	.000***	.000	.000***	.000	.000***	.000	.000***	.000
Intermed. *Posyandu*	.007***	.001	.007***	.001	.007***	.001	.007***	.002
Weak *Posyandu*	.008***	.002	.009***	.002	.009***	.002	.007***	.001
Poverty	-.004***	.001	-.004***	.001	-.004***	.001	-.003**	.001
Remote	-.400***	.052	-.361***	.068	-.375***	.068	-.384***	.069

***P ≤ 0.001; ** P ≤ 0.05; *P ≤ 0.1

Hypothesis 1 predicts that the number of midwives, CHC branches and promotion activities have a positive effect on the number of children weighed. Whereas Model 2 shows an unexpected significant negative effect of the number of branches on the number of weighed children, in Model 3, which includes the interaction effects, this relationship is no longer significant. The effect of the number of midwives and promotion activities is insignificant. We therefore refute hypothesis 1.

[28] This is based on the following. Given that the model estimates the log of expected counts, the estimated coefficient of poverty -0.004 shows the decrease in log counts. The exponent exp(-0.004) = 0.996 shows the (multiplicative) increase in counts, that is, with 1% increase in poverty the number of weighed children is 0.996 times higher. Thus an increase of 20% in poverty results in an expected count that is (0.996)20 = 0,923 times higher, that is a 8% decrease in the expected number of weighed children.

Hypothesis 2 suggests that the number of strong *Posyandu* will have a positive effect on the number of weighed children. Surprisingly, Model 3 reveals that the number of strong *Posyandu* (*Mandiri*) has a negative significant effect on the number of weighed children, and the co-efficient value increases when the interaction effect variables are included. In Model 3 that includes the outliers, there is no significant effect. Hence, we refute hypothesis 2.

Descriptive and regression results on remote and non-remote areas

Table 5-5 (below) shows that the average number of weighed children, the number of strong *Posyandu* and the frequency of promotion activities are lower in remote areas. The average of midwives and branches are higher in remote areas. The poverty rate is lower in non-remote areas. Given that the lowest number of strong *Posyandu* is zero, we delve into our data source to see how many CHCs there are without strong *Posyandu*. Our data shows that there are only 16 CHCs in remote areas that have strong *Posyandu*, which needs to be taken into account when interpreting the results.

Table 5-5 Description of data categorized in non-remote and remote area

Variable	Non-remote area					Remote areas				
	Obs[i]	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
Weighed U5	319	2438.1	1637.18	127	13018	90	795.26	599.43	64	3442
Midwife	320	12.29	6.60	1	36	100	17.03	13.68	1	56
Branch	320	2.39	1.52	0	9	100	3.13	2.03	0	11
Promotion	304	50.34	117.75	0	805	71	10.51	13.58	0	60
Strong Pos	291	4.08	5.89	0	24	100	0.26	0.86	0	7
Under-fives	319	3261.39	1993.18	331	16311	90	1263.51	956.46	157	5209
Intermed.Pos	291	7.90	13.41	0	77	100	6.14	9.84	0	50
Weak Pos	291	31.98	19.43	0	95	100	16.39	13.32	0	66
Poverty	307	35.52	14.74	9.08	87.78	95	58.78	22.75	8.31	100
List wise	268					61				

Obs refers to the number of CHC service coverage areas for which observations are available.

Table 5-6 presents the correlation between independent variables in non-remote and remote areas. It reveals a multicollinearity problem between the number of intermediate *Posyandu* and the number of children under five in the remote areas.

Table 5-7 presents the results of negative binomial analysis for remote and non-remote areas applying three Models for non-remote and remote areas both. Model 1 assesses the control variables, (weak and intermediate *Posyandu*) as well as the poverty rate. Model 2 adds the main variables and Model 3 adds the interaction variables.

Table 5-6 Correlation between independent variable in non-remote & remote area

Variable		Non-remote areas							Remote areas						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
1	Midwives	1							1						
2	Branch	.026	1						.199	1					
3	Prom	-.059	.141	1					.119	.170	1				
4	Strong Pos	.110	-.008	-.128	1				-.038	-.036	.287	1			
5	Under-fives	.206	.115	.019	.017	1			.207	.406	-.123	.114	1		
6	Weak Pos	-.044	.083	-.006	-.182	.236	1		-.378	.241	-.192	-.029	.223	1	
7	Interm. Pos	.417	.149	.102	.021	.355	-.285	1	.449	.461	-.043	.007	.684	-.302	1
8	Poverty	.069	.210	.016	.082	-.03	.354	.071	-.348	.065	-.158	-.212	-.219	.346	-.313

Table 5-7 Results of negative binomial regression on remote and non-remote areas

Variable	Model 1				Model 2				Model 3				Model 3 incl. outliers			
	Non-remote, N=277		Remote, N= 85		Non-remote, N = 275		Remote, N=61		Non-remote, N = 268		Remote, N=61		Non-remote, N = 277		Remote, N=61	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Midwife C					-.002	.003	.002	.004	-.003	.003	.013	.011	-.004	.003	.022	.029
Branch C					-.042***	.012	.030	.036	-.042***	.013	-.089	.115	-.029**	.013	.029	.037
Promotion C					.000	.000	-.002	.004	.000	.000	-.001	.005	.000	.000	.006	.008
Strong Pos					-.007**	.003	-.033	.047	-.005	.004	-.028	.061	-.002	.001	-.009	.062
CMid*Strong									.001	.001	.006	.006	.001***	.000	-.000	.006
CBranch*Strong									-.001	.002	-.067	.061	-.001	.000	.002	.000
CPromo*Strong									.000*	.000	.001	.002	.000**	.000	.000	.002
Under-fives	.000***	.000	.001***	.000	.000***	.000	.001***	.000	.000***	.000	.001***	.000	.000***	.000	.001	.000
Weak	.009**	.002	.004	.005	.009***	.002	-.002	.007	.009***	.002	-.002	.007	.007***	.002	-.009	.007
Intermediate	.006***	.001	.002	.005	.007***	.001	-.010	.008	.007***	.001	-.011	.008	.006***	.001	-.000	.008
Poverty	-.006***	.001	.001	.003	-.005***	.001	.001	.003	-.005***	.001	.001	.003	-.003***	.001	.000	.003

*** P ≤ 0.001; ** P ≤ 0.05; *P ≤ 0.1

Table 5-7 (Models 1, 2 and 3) shows that of the control variables, the number of under-fives has a significant positive effect in both non-remote and remote areas (though not for the remote areas in the analysis of Model 3 including outliers). The numbers of weak and intermediate *Posyandu* have a significant positive effect in non-remote areas but not in remote areas. The poverty rate has a negative significant effect in non-remote areas but an insignificant effect in remote areas in all Models.

Hypothesis 1 predicts that CHC characteristics have a positive effect on the number of weighed infants and children. The effect of the number of CHC midwives and promotion activities is insignificant in all Models. In Models 2 and 3 (also Model 3 that includes the outliers) the number of CHC branches has an unexpected negative significant effect on the number of weighed children, meaning that the number of children that are weighed decreases with the rise in number of CHC branches. We therefore refute hypothesis 1 in both remote and non-remote areas due to the insignificant effect.

Hypothesis 2 expects that the number of strong *Posyandu* will have a positive relationship with the number of weighed infants and children. In Model 2 the number of strong *Posyandu* has a negative significant effect on the number of weighed children in non-remote areas. However, in Model 3, this effect disappeared after including the interaction effect variables in the analysis. We therefore refute hypothesis 2 for both cases in remote and non-remote areas.

Hypothesis 3 expects that the number of strong *Posyandu* will affect the relation between CHC characteristics and number of weighed children positively. Model 3 shows this positive effect is significant only for the relation between CHC promotion activities and number of weighed children in the non-remote areas. However, the significance value is weak, and the co-efficient is very low. In Model 3 that includes the outliers, the interactions between strong *Posyandu* and midwives, and strong *Posyandu* and promotion activities in the non-remote areas, are positive and significant, but the co-efficient values are very small. Given these mixed results, we hesitate to accept hypothesis 3 for both cases in remote and non-remote areas.

Discussion and conclusion

Using information about almost 600 community health centers in Indonesia and the districts in which they operate, this study examined the co-production of community organizations (*Posyandu*) with CHCs in weighing children under five years old. Building on the literature on public service organization-community relations and co-production of services, the study proposed three hypotheses. The first stated that specific CHC characteristics (number of midwives, branches, and health promotion activities) have a direct positive association with the number of under-fives that are weighed. The second stated that strong *Posyandu* would have a direct positive association to the number of weighed under-fives, while the third predicted that this

type of *Posyandu* would positively reinforce the direct associations between the first two hypotheses.

Using negative binomial regression analysis, the analyses of the complete sample (Model 3) showed that the three CHC characteristics are not significantly related to the number of weighed children, whereas the analyses of the split sample (Model 3, both excluding and including outliers) showed an unexpected negative significant effect of the number of CHC branches on the number of weighed children in non-remote areas. These results hint at the relative unimportance – or even potential counterproductive effect – of these CHC characteristics regarding the number of weighed children, at least in this sample.

With regard to the importance of *Posyandu* in weighing children, we found a small but surprising negative effect of the number of strong *Posyandu* on the number of weighed children for the complete sample that excluded outliers (and no effect in the sample that included outliers) but not for the split sample. Unexpectedly, we found that other types of *Posyandu* – the weak and intermediate ones – are positively significantly related to the number of weighed children, in both complete and the non-remote samples. It is not so much the organizationally strong *Posyandu* that facilitate more children being weighed; on the contrary.

Only one hypothesis was partly confirmed, given that the analysis of both complete and non-remote samples showed a (small) significant interaction effect between the number of CHC promotion activities and number of strong *Posyandu*. This resonates with the idea that this type of *Posyandu* can help strengthen the effect of CHC promotion campaigns on the number of weighed children.

To understand the abovementioned unexpected findings, we re-examined the available policy information and conducted in-depth expert interviews with four local government health staff: two midwives, a public health officer and a nutritionist in Sumba Barat Daya, a regency in the province of Nusa Tenggara Timur, located in the middle of Indonesia. These experts provided a number of potential explanations for the fact why CHC characteristics do not or negatively relate to the number of children being weighed. First, all *Posyandu*, whatever type they are, have at least one CHC staff member that works with the *Posyandu*. This may not necessarily be a midwife, but another CHC staff member, which might explain the absence of an effect of the number of midwives. Regarding the significant negative effect of CHC branches on the number of weighed children in the non-remote sample, it was suggested that CHC branches mainly focus on addressing health problems (i.e. cure) and not so much on weighing children as a preventive measure.

With regard to the significant negative effect of strong *Posyandu* and the positive significant effect of weak and intermediate *Posyandu*, multiple mechanisms may have been at work. First, strong *Posyandu* are allowed to collect funds from their members, including the mothers that visit the *Posyandu*. This might make mothers reluctant to visit this kind of *Posyandu* and might make them choose other types of

Posyandu (weak or intermediate ones) that provide a free weighing service. This hints at the importance of the *cost dimension* in the decision to let a child be weighed.

Second, there might be an issue of *reverse causality* at work in relation to the strong *Posyandu* and the institutional context. In 2011, the Ministry of Home Affairs announced a regulation stating that it would work to reinforce the *Posyandu*. As our experts suggested, this regulation might have prompted the MoH and the Ministry of Home Affairs to encourage *Posyandu* to increase their human resources base, scope and autonomy as a way to increase the number of weighed children, particularly in areas with lower numbers. Hence, it may well be that the number of strong *Posyandu* has increased in areas *because* less children were being weighed.

Third, the unexpected findings could be understood in relation to differences in the degree of autonomy between the three types of *Posyandu* we distinguish. The weak and intermediate *Posyandu* are less autonomous than the strong *Posyandu* since they are more under the control of the government and still receive training from CHCs. This might imply that there is closer monitoring and scrutiny of the implementation of tasks in the weak and intermediate *Posyandu*, potentially resulting in positive effects of their weighing activities, despite the fact that they are less stable, implement less activities and have less coverage. Hence, there might be a *control mechanism* at work here, leading to more effective outcomes with regard to weighing children in those *Posyandu* that are more monitored.

The unexpected negative contribution of strong *Posyandu* and the surprising positive contribution of weak and intermediate *Posyandu* to the number of children being weighed thus underscores previous arguments that since community-based organizations do not have formal obligations to other institutions, this makes their input slightly unpredictable (Bovaird, 2007; Joost, et al., 2015).

Some limitations to this study have to be taken into account when interpreting its results. First, this study is based on cross-sectional data. Therefore, we could not analyze the relationship between the number of weighed children and its determinants over time (e.g., as a consequence of changes in CHC units or in policies). Second, the lack of significant findings for CHCs in remote areas is predominantly related to the small sample size. Third, we focused on the number of children as the dependent variable, which is not the same as the malnutrition rate, since the latter is an outcome indicator and the former an output indicator. Hence, future research might benefit from focusing on outcome or intervention indicators relating to malnutrition. Finally, the current study did not take into account indicators related to *quality of care* – another fruitful avenue of future research.

Nevertheless, this study's unexpected findings show the importance of studying co-production of health services by public service organizations and community organizations and the necessity to continue with attempts to more precisely define the boundary conditions under which co-production can contribute to desired health outcomes.

SIX

Summary and Conclusion

Introduction

What makes health care systems effective in catering to the needs of their populations? Posing a key challenge for most industrialized countries, this question ranks high on the agenda of policy makers, politicians, and scholars alike (Perleth, et al., 2001). Many countries have put their hopes on decentralization as a means to improve the effectiveness and efficiency of the sector (Saltman, et al., 2007). However, many attempts to assess the performance implications of decentralization remain inconclusive (e.g. Bossert & Beauvais, 2002). This is not surprising, since both decentralization and health care systems are complex and multifaceted phenomena and a large variety of factors affect their interplay (Regmi, 2013).

This dissertation aimed to shed more light on the largely neglected organizational side of decentralization in health care systems: the role of Community Health Centers (CHCs). Point of departure for this project is the assumption that variation in the structure, composition and management of these front-line organizations strongly affects health outcomes in their respective service coverage areas.

This book comprised four empirical studies on Community Health Centres (CHCs) in Indonesia and their capacity to generate high performance in health outcomes in the context of decentralization. Its key question is if and how CHC discretion and autonomy in Indonesia's decentralized era is related to their performance. Are performance differences between CHCs negligible, now that they have the discretion to tailor their operations to local circumstances, or do CHCs differ considerably in performance? If so, how can this be explained?

The focus was on four organizational dimensions of CHC discretion that resulted from the multi-layered decision-space created by decentralization in Indonesia. We relate these dimensions to specific outcomes of CHC activities, leading to four empirical studies on the following combinations of organizational dimensions and health care outcomes. These studies investigated the interplay between 1) CHC decision-space use and innovation; 2) CHC organization design and efficiency; 3) variations in CHC skill mix of professionals and efficacy; and 4) CHC collaboration with community organizations and children weighed (efficacy). Overall, the central research problem in this book can be summarized as follows: How can variation in CHCs' innovation, efficiency, and efficacy be explained by CHC organizational characteristics and social contexts?

This final chapter summarizes the findings of each empirical study and concludes with four more general propositions concerning the conditions favoring effective community health care services in Indonesia.

Summary of findings

Study 1: Community Health Centers innovation and decision-space use

There are various factors affecting organizational innovations in the health sector (Fleuren, et al., 2004). Our study, which focused on some of the institutional conditions that may facilitate or impede such innovations, allows for some general tentative observations.

First, the Decision-space Approach proved to be particularly useful to map the changes in these specific institutional contexts, because it allowed disentangling key decision and accountability domains. Our institutional analysis showed that arrangements during the first and the second wave of decentralization differ considerably, and that there is also quite some variation in decision-space and accountability across different domains during each phase. Whereas during the first phase decision-space was wide across most domains, autonomy of CHCs remained very low, creating a major stumbling block for capacity enhancing innovations. Since the second wave of decentralization, the institutional framework increased accountability pressures in combination with more decision autonomy with regard to CHC structure and function, but somewhat lower decision-space in the remaining domains. This combination seems to be favorable for capacity-enhancing innovations at CHC-level.

Second, our case analysis revealed that successful innovation initiatives were often built on the presence and cultivation of cooperative social networks, both with external and internal stakeholders. In the upper echelons, personal connections facilitated lobbying key decision makers in the system. Lower down in the hierarchy, social networks of CHC management, health staff and community members contributed to build the trust and commitment that was necessary for carrying out the sometimes major restructurings required to implement an innovation. Since these networking

capacities most likely differ considerably across CHCs, they may be one of the possible conditions explaining variation in their innovation potential.

Future research may benefit from our study in at least two ways. First, we found that increased organizational efficiency is one key ingredient of successful capacity-enhancing innovation. However, efficiency itself may be part of daily decision-space use in providing health service, particularly for health care service providers like CHCs. Hence, an in-depth study on decision-making processes at CHC level may be a fruitful endeavor. Second, our case studies showed the crucial role of mobilizing external stakeholders to contribute to health care provision. However, little is known about how management and employees of CHCs manage to activate sustainable collaborative networks that serve in improving organizational capacity.

To conclude, in 2015, Indonesia counted 548 local governments (Ministry of Home Affairs' Decree, 39/2015), and approximately 9,815 community health centers. The degree to which they will be able to deliver effective health care in the future will strongly depend on their ability to successfully adapt to local circumstances. Finding innovative methods to improve their organizational capacity will remain a crucial element to achieve this objective.

Study 2: Community Health Centers efficiency, organization design and context

Systematic statistical analyses of CHC efficiency are rare, also for the Indonesian context. Using performance information from a sample of almost 600 Indonesian CHCs, the present study revealed large variations in efficiency, and a clear pattern of conditions causing this variation.

Both organizational design and context matter for efficiency. With regard to design, horizontal differentiation, but not spatial differentiation, has an impact: none of the indicators for spatial differentiation – the number of branches, *Polindes, Puskesdes* – shows a systematic association with efficiency. As background interviews with four CHC directors reveal, this may be due to the fact that CHC management will react to declining numbers of patients either by closing down some of their *Pustu* and *Poskesdes* or by relying on alternative means to reach out to remote areas, like using ambulances as mobile CHCs.

In contrast, both types of horizontal differentiation affect efficiency. CHCs with a less diverse *staff mix* (number of roles present in its staff) outperform those with a more diverse staff mix. This linear negative association holds for CHCs in both remote and non-remote areas, and the effect size is the second strongest in the study. The effect of staff mix holds irrespective of the three context conditions investigated here: remoteness, poverty, and service area size.

Remoteness matters for the impact of the second organizational design condition, the *number of horizontal units*. Efficiency rates are highest for CHCs with an intermediate number (range 1–2) of horizontal units, but this effect holds only for CHCs in non-remote areas. The regression coefficient represents the strongest effect size in our study. Furthermore, the impact of the number of horizontal units becomes weaker

to the degree that the proportion of poor people increases in a CHC's service coverage area in non-remote areas. This implies that poverty may cancel out the eventual efficiency benefits a CHC may realize through keeping an intermediate number of horizontal units.

In sum, although the context conditions *poverty* and *remoteness* affect CHC efficiency, this effect is not direct. This conclusion is particularly relevant from a policy perspective. Being the first study to disentangle the joint impact of two closely related context conditions, a CHC's remoteness and the proportion of poor inhabitants in its service coverage area, our findings show that the socio-economic status of the population in its area does not directly influence CHC efficiency. Furthermore, in non-remote areas, the indirect effect of poverty – in the sense of tempering the efficiency gains from an intermediate number of horizontal units – is weak. CHCs with larger service coverage areas do slightly better, but this effect is weak. A third context condition has a direct effect: CHCs with larger service coverage areas do slightly better, but this effect is weak, too.

Some limitations to this study have to be taken into account when interpreting its results. First, one of the reasons why some relationships do not show up as strongly as expected on the basis of the theory relates to the fact that efficiency levels are not observed, but estimated in the first stage. Consequently, the efficiency levels that we use as observations of the dependent variable contain some measurement error. Second, this study is based on cross-sectional data. We, Therefore, we could not analyze the relationship between CHC efficiency and its determinants over time (e.g. as a consequence of changes in organizational design). Third, by splitting the sample into non-remote and remote areas, and given that the sample of remote CHCs is substantially smaller than the sample of non-remote CHCs, this might partly explain the lack of statistical significance in the analysis. Finally, we measured CHC input in terms of the number of staff available, not in terms of the actual hours they work. For example, a good nurse in a well-organized CHC in a poor and therefore unhealthier environment would have to be helping people almost continuously (because demand is higher), whereas her colleague working in a similar CHC located in a rich area might have less work to do because of a lower demand for care. These fluctuations in working hours could also explain differences in CHC efficiency but are not included in the analysis.

Nevertheless, the findings of this study suggest that the CDP framework is a useful theoretical point of departure for modeling variations in CHC efficiency. Future studies may also benefit from a comparative assessment of high-quality data on the *quality of care* provided by CHCs – a key dimension that the current study could not address.

Study 3: Community Health Centers efficacy and skill-mix of professionals

Systematic configurational analyses on skill-mix in primary health care institutions are rare also for the Indonesian context. Using configurational analysis from a sample of almost 600 Indonesian CHCs, the present study revealed large variations in skill-mix combination despite the standard of skill-mix stipulated by the Ministry of Health. The

study also revealed clear patterns of skill-mix configurations that lead to nominated CHCs efficacies.

In the CHCs in our sample, the 'standard' skill mix required by the government does not lead to higher efficacy in any of the functional domains. This suggests that a standard skill mix increases coordination costs (Barr, 1995). It could contribute to high quality services, something we did not analyze in this study. The analysis also suggests that as a mechanism, complementarity is important, given that most pathways require five or six professions in the configuration, and in most configurations professions from multiple functional groups are core or contributing factors. In terms of substitution, we did observe *within group* substitution especially, and not so much *between group* substitution, whereas we expected the latter to be more dominant, based on the job profile analysis. We expected nurses and midwives to be key in substituting for other staff, but our analyses show that these professions matter 'only' as contributing and not as core conditions. This means that the presence of GPs, midwives and nurses only contributes to high efficacy in combination with other core professions present, such as pharmacists, dentists or particular promotional staff. Even though the analysis did not result in one pathway to overall efficacy, the various pathways generated share similarities to some extent: GPs, nurses and midwives are contributing conditions; dentists, pharmacists and promotional staff are important – albeit in different compositions. Inductive analyses revealed that the presence of additional health facilities, and especially the presence of an ambulance service, might be an important additional characteristic of the high efficacy CHCs identified by our analysis.

In sum, the various professions in a skill-mix configuration complement each other. The presence of a specialist – such as a pharmacist or dentist – may reduce the workload of the generalist staff (e.g. nurses and GPs). This task differentiation in terms of specialists and generalists seems to be key to achieving high efficacy in certain domains, as shown in our sample. In terms of substitution, we conclude that substituting for staff requires an overlap in tasks and expertise for it to contribute to high efficacy, given that substitution within a functional group is more prominent than substitution between functional groups

Various limitations to this study need to be taken into account. First, skill mix is one of many factors that may contribute to CHC efficacy, alongside organization design and context characteristics or management style (Antunes & Moreira, 2013) and the quality of health facilities (Andayasary, 2014). This is apparent in the relatively low unique coverage rates in the analysis. Second, our definition of professions in the skill mix did not include differentiation within a profession, for example, between professional midwives and 'ordinary' midwives, with the professionals having obtained additional certification and thus representing additional knowledge and skills compared to the other midwives (Antunes & Moreira, 2013; Global Health Workforce Alliance and World Health Organization, 2014). Third, we focused on efficacy and not quality of care or patient satisfaction. Finally, this empirical study is limited to one case: Indonesian CHCs in the context of health sector decentralization, in one year (2011) and based on one kind of information (documents and archival material).

Despite the above limitations, this study has advanced our understanding of the relation between CHC skill mix and performance by systematically comparing a sample of CHCs in one country, using fuzzy set Qualitative Comparative Analysis (fs-QCA). The results lead to a refinement of the general ideas of complementarity and substitution that are currently used in the literature and debate on skill mix in the health sector: there are various skill-mix pathways to high efficacy in CHCs, related to context and facilities, in which complementarity and substitution mechanisms play different roles. Future studies can build upon this work by applying similar systematic approaches for national or cross-country comparisons, or by comparing private and public health institutions.

Study 4: The co-production between Community Health Centers and community organizations

The fourth empirical paper asks if and how specific CHC characteristics and the type and number of *Posyandu* relate to the number of children weighed in a community, as an example of one particular health care output (i.e. efficacy). The study categorizes the *Posyandu* in three types, based on the strength of their human resource base, their scope of activities and member base, and their degree of autonomy: strong, intermediate and weak *Posyandu*.

We expected that CHCs who operate in areas with strong community based service organizations (*Posyandu*) will be more effective in reaching the population to have their children weighed, compared to CHCs that do not work in areas with such strong *Posyandu*. However, we assume that the performance in this domain also depends on how well CHCs internally organize themselves to reach out to local communities, in particular the number of midwives, branches and promotional activities. Moreover, we expect a positive interaction effect of CHC characteristics and the presence of strong *Posyandu*.

We compiled an archival data set from 37 local government reports on health CHC profiles that were published in 2011 and applied *negative binomial regression analyses* to test our hypotheses. The analyses of the complete sample showed that the three CHC characteristics are not significantly related to the number of weighed children under 5 years old (i.e. the number of midwives, CHC branches, and promotional activities), whereas the analyses of the split sample showed an unexpected negative significant effect of the number of CHC branches on the number of children being weighed in the non-remote areas. These results hint at the relative unimportance - or even potential counterproductive effect - of these CHC characteristics with regard to the number of children that are weighed, at least in this sample.

With regard to the importance of *Posyandu* in weighing children, we found a small but surprising negative effect of the number of strong *Posyandu* on the number of children that are weighed for the complete sample but not for the split sample. Moreover, we found that other types of *Posyandu* – i.e. the weak and intermediate ones - unexpectedly are positively and significantly related to the number of weighed children, both in the complete and the non-remote sample. Hence, it is not so much the

Posyandu that are organizationally strong that facilitate that more children are being weighed, on the contrary.

Only one hypothesis was partly confirmed, given that the analysis of both the complete and the non-remote sample showed a (small) significant interaction effect between the number of CHC promotional activities and the number of strong *Posyandu*. This resonates with the idea that this type of *Posyandu* can help strengthen the effect of CHC promotional activities on the number of children being weighed.

The above mentioned unexpected findings can be explained in multiple ways. First, all *Posyandu*, whatever type they are, have at least one CHC staff member that works with the *Posyandu*. This may not necessarily be a midwife, but another CHC staff member, which might explain the absence of an effect of the number of midwives. Furthermore, regarding the significant negative effect of CHC branches on the number of children that are weighed in the non-remote sample, it was suggested that CHC branches are mainly focused on addressing health problems (i.e. cure) and not so much on weighing children as a preventive measure.

With regard to the significant negative effect of strong *Posyandu* and the positive significant effect of weak and intermediate *Posyandu*, multiple mechanisms may have been at work. First, strong *Posyandu* are allowed to collect funds from its members, including the mothers that visit the *Posyandu*. This might result in mothers' reluctance visiting this kind of *Posyandu* and might make them choose other types of *Posyandu* (i.e. weak or intermediate ones) that provide a free weighing service. This hints at the importance of the *cost dimension* in the decision to let a child be weighed.

Second, there might be an issue of *reverse causality* at work in relation to the strong *Posyandu* and the institutional context. In 2011, the Ministry of Home Affairs announced a regulation stating that it would work to reinforce the *Posyandu*. This regulation might have triggered the Ministry of Health and the Ministry of Home Affairs, as our experts suggested, to encourage *Posyandu* to increase their HR base, scope and autonomy as a way to increase the number of weighed children, particularly in areas where this number was lower. Hence, it may well be that the number of strong *Posyandu* has increased in areas *because* less children were being weighed.

Third, the unexpected findings could be understood in relation to differences in the degree of autonomy between the three types of *Posyandu* we distinguish. The weak and intermediate *Posyandu* are less autonomous than the strong *Posyandu* since they are more under the control of the government and still receive training from CHCs. This might imply that there is closer monitoring and scrutiny of the implementation of tasks in the weak and intermediate *Posyandu*, potentially resulting in positive effects of their weighing activities, despite the fact that they are less stable, implement less activities and have less coverage. Hence, there might be a *control mechanism* at work here, leading to more effective outcomes with regard to weighing children in those *Posyandu* that are more monitored.

Some limitations to this study have to be taken into account when interpreting its results. First, this study is based on cross-sectional data. We, therefore, could not

analyze the relationship between the number of weighed children and its determinants over time, for example, as a consequence of changes in CHC units or in policies. Second, we focused on the number of children as the dependent variable, which is not the same as the malnutrition rate, since the latter is an outcome indicator and the former an output indicator. Future research could, therefore, more focus on outcome or intervention indicators relating to malnutrition. Finally, the current study did not take into account indicators related to the *quality of care*, something, which in future studies could be included.

This study's unexpected findings show the importance of studying co-production of health services by public service organizations and community organizations and the necessity to continue with attempts to more precisely define the boundary conditions under which co-production can contribute to desired health outcomes.

Conclusion

Before concluding, several obvious limitations of our research design should be mentioned. The studies in this book cover a relatively small sample (589 or 6% of all 9000 CHCs), rely mostly on archival material, are restricted to cross-sectional information on a single year (2011), and focus exclusively on quantitative indicators of health care effectiveness rather than the perceived quality of care. Future research may benefit from a more comprehensive research design involving a larger sample, and complement longitudinal data on effectiveness with information on perceived quality of care. For such research designs to become feasible, much can be gained by a more comprehensive effort of the Indonesian government to ensure the consistent documentation of key performance indicators of CHCs.

These limitations notwithstanding, the current study is among the first to provide a more systematic assessment of performance differences between CHCs after Indonesia's far reaching decentralization. It shows that these differences are quite pronounced, implying that there is still room for improvement with regard to the national policies to safeguard CHC capacity and performance.

We would like to conclude with four more general tentative propositions concerning the conditions favoring effective community health care services in Indonesia.

Proposition 1. Personal trust relations between Community Health Center staff and external stakeholders facilitate the development of innovative practices in primary health care.

We found that successful innovation initiatives often built on the presence of cooperative social networks, in which CHC staff had frequent contact with a variety of external stakeholders. In the upper echelons, personal connections and the

interpersonal trust these contacts nourished facilitated lobbying key decision makers in the system. Lower down in the hierarchy, social networks of CHC management, health staff and community members contributed to build the trust and commitment that was necessary for carrying out the - sometimes major - restructurings required to implement an innovation. Since these networking capacities most likely differ considerably across CHCs, they may be one of the possible conditions explaining variation in their innovation potential.

Proposition 2. Horizontal differentiation affects the efficiency of Community Health Centers.

Our study shows that the organizational structure of CHCs matters for health care efficiency. More specifically, a key characteristic of the most efficient CHCs in our study was that their staff mix was less diverse, compared to the seven types of occupations that the government has set as a requirement for CHCs. In addition, efficient CHCs in non-remote areas had an intermediate level of horizontal differentiation (one or two units). However, it must be noted that efficient health care provision is not necessarily the same as high quality health care provision.

Proposition 3. Skill mix affects Community Health Center efficacy mainly through complementarity rather than through substitution.

The skill mix configuration in a Community Health Center matters for health care efficacy. The main mechanism through which this is achieved is complementarity, i.e. the presence of different specialist professions within one functional group seem to reduce the workload of generalists. Substitution between functional groups might not necessarily relate to more effective health care, even though it is often assumed that, for example, nurses can take over tasks of doctors. Hence, our study suggests to be careful before opting for the substitution of specialists by generalist health staff across functional groups.

Proposition 4. Co-production between Community Health Centers and *Posyandu*s may improve health care output, but in unexpected ways.

The co-production of health services by both CHCs and community based organizations such as *Posyandu* can be beneficial for health outputs, as the fourth empirical study showed. However, we detected unexpected patterns in the data, warning us for simplified reasoning regarding the characteristics of and conditions under which *Posyandu* might contribute to delivering health outcomes. Additional research is needed in order more precisely define the boundary conditions under which co-production can contribute to desired health outcomes.

Taken together, the evidence presented in the four studies in this book suggests that the organizational dimension of a Community Health Center matters, and that scholars and policy makers may benefit from devoting more attention to this neglected dimension in their future attempts to improve the efficiency of the Indonesian health care sector.

Samenvatting

Decentralisatie en prestaties van lokale gezondheidscentra in Indonesië

Hoe kunnen zorgstelsels effectief in de behoeften van hun bevolking voorzien? Deze vraag staat hoog op de agenda van zowel beleidsmakers als politici en academici. Veel landen hebben hun hoop gevestigd op decentralisatie als middel om de effectiviteit en efficiëntie van de gezondheidszorg te verbeteren. De precieze gevolgen van decentralisatie zijn echter nog niet duidelijk. Dit is niet verrassend, want zowel decentralisatie als zorgstelsels zijn complexe en veelzijdige fenomenen, en de interactie daartussen wordt door een grote verscheidenheid aan factoren beïnvloed.

Dit proefschrift wil meer inzicht geven in de grotendeels onderbelichte organisatorische kant van decentralisatie in zorgstelsels: de rol van lokale gezondheidscentra. Verondersteld wordt dat variatie in de organisatiestructuur, de samenstelling en het management van deze eerstelijns zorginstellingen invloed heeft op hun resultaten en de gezondheidsuitkomsten in hun servicegebied.

Dit proefschrift omvat vier empirische studies naar lokale gezondheidscentra in Indonesië en hun resultaten, in de context van decentralisatie. De nadruk ligt op vier organisatorische kenmerken van lokale gezondheidscentra, gebaseerd op de gelaagde beslisruimte die ontstond door decentralisatie in Indonesië. We hebben deze factoren gekoppeld aan specifieke uitkomsten van het werk van lokale gezondheidscentra. Dit heeft geleid tot vier empirische studies naar de volgende combinaties van organisatorische factoren en uitkomsten van het werk van lokale gezondheidscentra: 1) beslisruimte van gezondheidscentra en innovatie; 2) structuur van gezondheidscentra en efficiëntie; 3) variaties in skill mix van gezondheidscentrumprofessionals en effectiviteit, en 4) samenwerking van gezondheidscentra met lokale zorgorganisaties en het aantal gewogen kinderen. De centrale onderzoeksvraag in dit proefschrift luidt: Hoe kunnen variaties in de innovatie, efficiëntie en effectiviteit van lokal gezondheidscentra worden verklaard door hun organisatorische kenmerken en sociale context?

Datasets en informatiebronnen

De informatie over de kenmerken en prestaties van gezondheidscentra is afkomstig uit diverse bronnen. We hebben verscheidene documenten geanalyseerd. Zo analyseerden we ***overheidsvoorschriften*** om de mate van beslisruimte en controle te vergelijken, maar ook om de voorwaarden voor bepaalde organisatorische kenmerken van een gezondheidscentrum te bepalen, bijvoorbeeld of er een 24-uurs eerstehulppost aanwezig is en hoeveel professionals een gezondheidscentrum zou moeten tellen. Daarnaast bestudeerden we socialemediabronnen met informatie over activiteiten van gezondheidscentra, zoals ***socialemediaberichten*** over innovaties. Ook analyseerden we online functiebeschrijvingen van verscheidene beroepen binnen gezondheidscentra.

Interviews met deskundigen zijn gebruikt om aanvullende informatie te verzamelen. De deskundigen in dit proefschrift zijn directeuren van gezondheidscentra, die ons met hun specifieke en exclusieve kennis hebben geholpen te begrijpen hoe en in welke context gezondheidscentra in de praktijk functioneren. De interviews werden tweemaal afgenomen: aan het begin van het onderzoek en nadat de resultaten bekend waren.

Voor de tweede, derde en vierde studie gebruikten we ***een dataset bestaande uit een steekproef van 589 gezondheidscentra in Indonesië*** uit 2011. Dit bedraagt 6,4% van het totale aantal gezondheidscentra. Er is weinig informatie beschikbaar over prestaties van gezondheidscentra in Indonesië, vanwege hun geografische spreiding en de onderontwikkelde infrastructuur van informatiebeheersystemen in de Indonesische gezondheidszorg. Er is voor het jaar 2011 gekozen omdat dit het meest recente jaar was waarover de meeste informatie beschikbaar was. Voor de steekproef hebben we twee informatiebronnen gecombineerd: we verzamelden gegevens over gezondheidscentra uit 2011 van ***de officiële website van het Ministerie van Volksgezondheid*** en combineerden deze informatie met gegevens van ***37 districtsrapporten over de volksgezondheid*** uit 2011, zoals gepubliceerd door de gezondheidsdienst van de betreffende districten. Deze rapporten geven actuele informatie per gezondheidscentrum.

Vier studies naar Indonesische gezondheidscentra

De vier studies in dit proefschrift gaan ervan uit dat we de prestaties van gezondheidscentra alleen kunnen beoordelen als we rekening houden met zowel de organisatorische kenmerken van gezondheidscentra als de kenmerken van het zorgstelsel. Hieronder volgt een samenvatting van de studies.

Studie 1: Innovatie van gezondheidscentra en beslisruimte

Het Ministerie van Volksgezondheid bepaalt nationale gezondheidsdoelstellingen (zoals terugdringing van moedersterfte in 2005). Op organisatorisch niveau hebben

lokale gezondheidscentra de ruimte om te bepalen hoe zij deze nationale doelstellingen vertalen naar strategieën en programma's. Verwacht wordt dat gezondheidscentra, als zij gebruikmaken van deze organisatorische beslisruimte, op innovatieve wijze kunnen reageren op gezondheidsproblemen en -behoeften in de gemeenschap en hun diensten kunnen afstemmen op de specifieke omstandigheden. Het feit dat gezondheidscentra deze beslisruimte hebben, biedt echter geen garantie voor innovaties. Dus de hoofdvraag van de eerste empirische studie luidt: *onder welke voorwaarden bevordert decentralisatie van de Indonesische gezondheidszorg innovaties op regionaal en organisatorisch niveau (het niveau van lokale gezondheidscentra)?*

Wij hanteren een '*decision-space approach*' en stellen dat beslisruimte in combinatie met passende controlemechanismen zal leiden tot innovaties ter verbetering van de gezondheidsresultaten. Beslisruimte wordt omschreven als een intrinsiek kenmerk van gezondheidscentra, en de controlemechanismen verwijzen naar de relaties tussen de verschillende actoren in het zorgstelsel, zoals organisaties uit andere sectoren en domeinen (d.w.z. wetgevend).

De twee decentralisatiegolven die Indonesië heeft gekend, bieden gelegenheid tot een gedetailleerd vergelijkend onderzoek naar het effect van verschillende beleidsmaatregelen op innovaties in de gezondheidszorg binnen dezelfde sociaal-culturele context. Met behulp van een *vergelijkende beleidsanalyse* brengen we in kaart hoe de belangrijkste beleidsaspecten in de gezondheidszorg tussen de eerste en de tweede golf van decentralisatie zijn veranderd. *Beleidsdocumenten en verordeningen* zijn onze belangrijkste bronnen voor deze analyse op de Indonesische situatie. Gezien het gebrek aan innovaties binnen het zorgstelsel van Indonesië, doen we nader onderzoek naar de weinige gevallen waarin wel sprake is van innovatie. Het doel van deze casestudyanalyse is om mogelijke overeenkomsten vast te stellen in de voorwaarden en methoden voor innovatie tijdens beide decentralisatiegolven. Onze belangrijkste informatiebronnen voor deze stap zijn *beschrijvingen van eerdere casestudy's en berichten in de media*.

Deze studie leidt tot twee belangrijke bevindingen. Ten eerste bleek de *decision-space approach* nuttig om veranderingen in de specifieke beleidssituaties in kaart te brengen; we konden ze belangrijke domeinen van besluitvorming en controle. Onze beleidsanalyse toont aan dat de beleidsmaatregelen aanzienlijk verschillen tussen de eerste en de tweede decentralisatiegolf, en dat er ook behoorlijk wat variatie is in beslisruimte en controle binnen verschillende domeinen. In de eerste fase was de beslisruimte binnen de meeste domeinen vrij groot, maar de autonomie van gezondheidscentra bleef zeer laag, wat een groot struikelblok vormde voor innovaties ter verbetering van de effectiviteit. Tijdens de tweede decentralisatiegolf werd de controle vanuit het beleidskader vergroot, in combinatie met meer autonomie qua organisatiestructuur en functie van gezondheidscentra, maar er was een enigszins lagere beslisruimte binnen andere domeinen. Deze combinatie lijkt gunstig te zijn voor innovaties ter verbetering van de effectiviteit op het niveau van gezondheidscentra.

Ten tweede bleek uit onze casestudyanalyse dat succesvolle initiatieven tot innovatie vaak berustten op de aanwezigheid en ontwikkeling van sociale netwerken met zowel externe als interne stakeholders. Op het hoogste niveau maakten persoonlijke contacten het makkelijker om druk uit te oefenen op beleidsmakers binnen het stelsel. Op lager niveau leidden sociale netwerken tussen het management van gezondheidscentra, zorgmedewerkers en gemeenschapsleden tot meer toewijding en vertrouwen, wat nodig is voor de soms grote herstructureringen die bij innovaties komen kijken. Aangezien deze netwerkcapaciteiten waarschijnlijk aanzienlijk verschillen tussen gezondheidscentra, kan dit een van de mogelijke oorzaken zijn voor variaties in hun innovatiepotentieel.

Studie 2: Efficiëntie van gezondheidscentra, organisatie en context

Het Ministerie van Volksgezondheid bepaalt onder welke voorwaarden een lokaal gezondheidscentrum geopend mag worden. In elke regio met 30.000 tot 60.000 inwoners zou een gezondheidscentrum aanwezig moeten zijn. De centrale overheid bepaalt ook de organisatiestructuur van een gezondheidscentrum, bijvoorbeeld dat ze vestigingen op dorpsniveau mogen hebben, of een klinische afdeling als er geen ziekenhuis in de buurt is.

Op organisatieniveau hebben gezondheidscentra de beslisruimte om een eigen structuur en begroting vast te stellen, binnen bepaalde grenzen. Zo kunnen gezondheidscentra uitbreiden op basis van demografische overwegingen, zoals de bevolkingsgrootte in hun servicegebied. Het Ministerie van Volksgezondheid legt gezondheidscentra ook geen beperkingen op wat betreft het aantal ruimtelijke eenheden. Dit stelt gezondheidscentra in staat vestigingen op dorpsniveau te hebben, waardoor de gezondheidszorg nog dichter bij de gemeenschap komt te staan. Datzelfde geldt voor horizontale eenheden, zoals een 24-uursafdeling of een eerstehulppost, al is daar wel toestemming nodig van de instellingen hoger in de hiërarchie.

We verwachten dat gezondheidscentra hun organisatiestructuur zullen aanpassen aan de specifieke omstandigheden van hun servicegebied, leidend tot efficiëntere gezondheidscentra, wat betekent dat sommige gezondheidscentra betere resultaten bereiken met dezelfde middelen. De tweede empirische studie richt zich dus op de vraag: *Is er variatie in de efficiëntie van gezondheidscentra in Indonesië, en zo ja, kan dit worden verklaard door hun context en organisatorische kenmerken?*

Op basis van de *contingency theory* passen we een *context-design performance*-kader toe. Hierin wordt verondersteld dat de efficiëntie van gezondheidscentra wordt bepaald door de mate waarin hun organisatiestructuur aansluit op hun sociale context (Marathe, et al., 2007) De organisatiestructuur verwijst naar de interne organisatorische kenmerken van gezondheidscentra, in het bijzonder de mate van horizontale en ruimtelijke differentiatie. De sociale context verwijst naar de kenmerken van het servicegebied, zoals armoede en afgelegenheid.

Met behulp van *Data Envelopment Analysis* (DEA) hebben we voor 589 gezondheidscentra een technische efficiëntiescore berekend. We bestudeerden de

relatie tussen de efficiëntie van gezondheidscentra, hun horizontale en ruimtelijke differentiatie en contextkenmerken (armoede, afgelegenheid) met behulp van een *Tobit-regressieanalyse*.

Uit de resultaten blijkt dat zowel de organisatiestructuur als de sociale context van belang zijn voor de efficiëntie van gezondheidscentra. De organisatiestructuur wordt in twee opzichten beïnvloed door horizontale differentiatie (maar niet door ruimtelijke differentiatie). Gezondheidscentra met een minder diverse *skill mix* (aantal verschillende beroepen van het personeel) presteren beter dan gezondheidscentra met een diverser personeelsbestand. Daarnaast heeft de afgelegenheid van het gebied invloed op de tweede factor van de organisatiestructuur, het *aantal horizontale eenheden*. De efficiëntiescores zijn het hoogst voor gezondheidscentra met een matig aantal (1-2) horizontale eenheden, maar dit effect geldt slechts voor gezondheidscentra in niet-afgelegen gebieden. Bovendien wordt het effect van het aantal horizontale eenheden in deze niet-afgelegen gebieden kleiner naarmate het aandeel arme mensen in het servicegebied van een gezondheidscentrum toeneemt. Dit impliceert dat de eventuele efficiëntievoordelen van een gezondheidscentrum met een matig aantal horizontale eenheden teniet kunnen worden gedaan door armoede.

De contextuele factoren *armoede* en *afgelegenheid* hebben wel invloed op de efficiëntie van gezondheidscentra, maar niet direct. Deze conclusie is in het bijzonder relevant vanuit beleidsoogpunt. Uit deze eerste studie waarin is gekeken naar het individuele effect van twee nauw verwante contextfactoren – de afgelegenheid van een gezondheidscentrum en het aandeel arme inwoners in het servicegebied – blijkt dat de sociaaleconomische status van de bevolking in het servicegebied geen directe invloed heeft op de efficiëntie van een gezondheidscentrum. In niet-afgelegen gebieden is ook het indirecte effect van armoede – namelijk het tenietdoen van de efficiëntievoordelen bij een matig aantal horizontale eenheden – klein. Een derde contextfactor heeft wel een direct effect: gezondheidscentra met een groter servicegebied doen het iets beter, maar ook dit effect is klein.

Studie 3: Effectiviteit van gezondheidscentrumprofessionals en skill mix

Verordening 128/2004 van het Ministerie van Volksgezondheid noemt acht verschillende zorgberoepen (de skill mix) die in elk gezondheidscentrum beschikbaar moeten zijn: huisarts, tandarts, verloskundige, verpleegkundige, voedingsdeskundige, apotheker, deskundige op het gebied van volksgezondheid, en hygiënist. Formeel moeten deze specialismen vertegenwoordigd zijn; verondersteld wordt dat een gezondheidscentrum deze professionals nodig heeft om zijn vier kerntaken te kunnen vervullen.

Lokale gezondheidscentra en regionale gezondheidsdiensten hebben de beslisruimte om aanvullende gezondheidsprofessionals voor een gezondheidscentrum te selecteren. Uit de verzamelde gegevens (2011) blijkt dat het aantal beroepen van het medisch personeel in gezondheidscentra varieert van twee tot tien, waarbij meer dan 50% van de steekproef niet de vereiste acht beroepen in huis heeft. Deze variatie in skill mix suggereert dat sommige gezondheidscentra onvoldoende capaciteit hebben om

hun vier kerntaken uit te voeren. Daarom luidt de onderzoeksvraag van de derde empirische studie: *welke combinatie(s) van vaardigheden (gedefinieerd als beroepen) leidt tot een hogere effectiviteit van Indonesische gezondheidscentra?*

We baseren ons op eerder onderzoek waarin wordt gesteld dat de variatie in prestaties van gezondheidsinstellingen wordt veroorzaakt door variaties in hun skill mix-samenstelling. Deze relatie kan volgens de literatuur door twee mechanismen worden verklaard: *vervanging* en *complementariteit* (Buchan & Poz, 2002; Misangyi & Acharya, 2014). Wij stellen dat gezondheidscentra met een geringere skill mix dan de norm nog steeds optimaal kunnen presteren dankzij het mechanisme van vervanging.

Met behulp van fuzzy set Qualitative Comparative Analysis (QCA) onderzoeken we welke combinatie(s) van vaardigheden (gedefinieerd als beroepen) tot hogere effectiviteit van Indonesische gezondheidscentra leidt. We definiëren vier effectiviteitsindicatoren op basis van de vier kerntaken van gezondheidscentra: eerstelijns gezondheidszorg, moeder- en zuigelingenzorg, preventie van infectieziekten en gezondheidsbevordering. We bepalen de effectiviteitsvariabelen aan de hand van de dataset gebaseerd op de profielrapporten van 598 gezondheidscentra.

We delen de verschillende beroepen in naar de vier kerntaken, gebaseerd op wie hoofdverantwoordelijk is voor de uitvoering (aan de hand van een analyse van *functiebeschrijvingen*). Verder wordt onderzocht welke mechanismen de relatie tussen skill mix en prestaties van een gezondheidscentrum (oftewel de effectiviteit) verklaren. We analyseren *functiebeschrijvingen* om te kunnen afleiden welke personeelsleden elkaar zouden kunnen vervangen.

Bij de gezondheidscentra in onze steekproef leidt de skill mix die door de overheid wordt vereist bij geen van de kerntaken tot hogere effectiviteit. Dit lijkt erop te wijzen dat een standaard skill mix de coördinatiekosten verhoogt (Barr, 1995). Het zou wel kunnen bijdragen aan een hogere kwaliteit van diensten, maar dat is niet in deze studie onderzocht.

De analyse suggereert ook dat complementariteit een belangrijk mechanisme vormt, aangezien in de meeste configuraties meestal vijf of zes beroepen vertegenwoordigd zijn, en in de meeste configuraties beroepen uit meerdere functiegroepen een kern- of aanvullende voorwaarde zijn. Vervanging zagen we vooral *binnen groepen* en niet zozeer *tussen groepen*, hoewel we op basis van de analyse van functieprofielen hadden verwacht dat laatstgenoemde vaker zou voorkomen. We hadden verwacht dat vooral verpleegkundigen en verloskundigen andere medewerkers zouden vervangen, maar onze analyse toont aan dat deze beroepen 'alleen' een bijdrage leveren, maar geen kernvoorwaarde vormen.

Hoewel de analyse niet leidde tot één enkele aanpak ter verbetering van de effectiviteit, zijn er wel enige overeenkomsten tussen de verschillende configuraties vast te stellen: huisartsen, verpleegkundigen en verloskundigen leveren een aanvullende bijdrage; tandartsen, apothekers en promotiemedewerkers zijn belangrijk, zij het in verschillende combinaties. Uit een inductieve analyse bleek dat de aanwezigheid van extra gezondheidsvoorzieningen, en dan in het bijzonder van een

ambulancedienst, een belangrijk aanvullend kenmerk zou kunnen zijn van gezondheidscentra met een hoge effectiviteit.

Samenvattend blijkt dat de diverse beroepen in een skill mix elkaar aanvullen. De aanwezigheid van een specialist – zoals een apotheker of een tandarts – kan de werkbelasting van het generalistische personeel (oftewel de verpleegkundigen en huisartsen) verminderen. Deze differentiatie in taken tussen specialisten en generalisten lijkt van groot belang om de effectiviteit te vergroten, zoals aangetoond in onze steekproef. Wat betreft vervanging komen we tot de conclusie dat dit alleen bijdraagt aan een hogere effectiviteit als er overlap bestaat tussen de taken en kennis van medewerkers, aangezien vervanging vaker voorkomt binnen functiegroepen dan tussen functiegroepen.

Studie 4: Coproductie tussen lokale gezondheidscentra en lokale zorgorganisaties

Toezicht houden op het gewicht van kinderen is essentieel om ondervoeding vroegtijdig te ontdekken. Het wegen van kinderen in de uitdagende demografische en geografische omstandigheden van Indonesië vereist samenwerking tussen lokale gezondheidscentra en lokale zorgorganisaties. Deze studie analyseert deze samenwerking en het effect hiervan op het aantal kinderen dat wordt gewogen.

Twee verordeningen van het Indonesische Ministerie van Binnenlandse Zaken en het Ministerie van Volksgezondheid schrijven voor dat lokale gezondheidscentra moeten samenwerken met *Posyandu* (lokale zorgorganisaties) bij het verlenen van gezondheidszorg. *Posyandu* zijn organisaties die op buurtniveau actief zijn. Zij helpen gezondheidscentra om de gemeenschap te bereiken. Gezondheidscentra hebben de beslisruimte om deze lokale organisaties aan te zetten samen met hen gezondheidszorg te leveren.

Op basis van hun personele middelen, de omvang van hun activiteiten en ledenbestand, en hun mate van autonomie, worden de *Posyandu* in drie typen verdeeld: sterke, middelmatige en zwakke *Posyandu*. De vierde empirische studie richt zich op de vraag *of en hoe de specifieke kenmerken van lokale gezondheidscentra en het type en aantal sterke Posyandu verband houden met het aantal gewogen kinderen in een gemeenschap,* als voorbeeld van één specifiek gezondheidsresultaat (oftewel de effectiviteit).

Deze studie richt zich op de *relatie tussen organisatie en gemeenschap* en *coproductie van gezondheidszorg*. We verwachten dat gezondheidscentra in gebieden met sterke lokale zorgorganisaties (*Posyandu Mandiri*) er beter in slagen de bevolking aan te zetten hun kinderen te laten wegen dan gezondheidscentra die niet opereren in gebieden met dergelijke sterke *Posyandu*. We nemen echter aan dat de prestaties op dit gebied ook afhangen van een goede interne organisatie van gezondheidscentra, vooral wat betreft het aantal verloskundigen, lokale vestigingen en promotieactiviteiten.

Bijgevolg stellen we dat er een positieve relatie bestaat tussen het aantal kinderen dat wordt gewogen, bepaalde specifieke kenmerken van de lokale

gezondheidscentra (d.w.z. het aantal verloskundigen, lokale vestigingen en promotieactiviteiten) en het aantal sterke *Posyandu* die helpen bij de zorgverlening. Verder verwachten wij een positieve interactie effect tussen kenmerken van gezondheidscentra en de aanwezigheid van sterke *Posyandu*. We hebben een dataset samengesteld uit 37 profielrapporten van gezondheidscentra die in 2011 door regionale gezondheidsdiensten werden gepubliceerd en we hebben een *negatieve binomiale analyse* toegepast om onze hypothesen te testen.

Uit de analyse van de volledige steekproef bleek dat de drie kenmerken van gezondheidscentra (d.w.z. het aantal verloskundigen, lokale vestigingen en promotieactiviteiten) geen duidelijk verband houden met het aantal gewogen kinderen onder de 5 jaar, terwijl in de subgroep niet-afgelegen gebieden een onverwacht negatief effect naar voren kwam tussen het aantal lokale vestigingen van een gezondheidscentrum en het aantal gewogen kinderen. Deze resultaten lijken erop te wijzen dat de drie kenmerken van gezondheidscentra relatief weinig – of mogelijk zelfs een averechts – effect hebben op het aantal gewogen kinderen, in elk geval in deze steekproef.

Wat betreft de invloed van *Posyandu* op het wegen van kinderen ontdekten we een klein maar onverwacht negatief effect van het aantal sterke *Posyandu* op het aantal gewogen kinderen bij de volledige steekproef, maar niet bij de subgroepanalyse. Verder ontdekten we dat andere typen *Posyandu* – d.w.z. de zwakke en middelmatige – onverwacht een significant positief effect hebben op het aantal gewogen kinderen, zowel in de volledige steekproef als in de subgroep niet-afgelegen gebieden. Dit suggereert dat het niet zozeer de sterk georganiseerde *Posyandu* zijn die ervoor zorgen dat er meer kinderen worden gewogen. Integendeel, zelfs.

Slechts één hypothese werd gedeeltelijk bevestigd, aangezien er uit de analyse van zowel de volledige steekproef als de subgroep niet-afgelegen gebieden een (klein) significant interactie effect naar voren kwam tussen het aantal promotieactiviteiten van een gezondheidscentrum en het aantal sterke *Posyandu*. Dit strookt met het idee dat dit type *Posyandu* het effect van promotieactiviteiten van een gezondheidscentrum op het aantal gewogen kinderen kan helpen versterken.

Er zijn verschillende verklaringen voor bovenvermelde onverwachte resultaten. Ten eerste werken alle *Posyandu*, ongeacht het type, samen met minstens één personeelslid van een gezondheidscentrum. Dit is niet per se een verloskundige, maar kan ook een ander personeelslid zijn, wat zou kunnen verklaren waarom het aantal verloskundigen niet van invloed is. Het significante negatieve effect van het aantal lokale vestigingen van een gezondheidscentrum op het aantal gewogen kinderen in de subgroep niet-afgelegen gebieden, kan mogelijk worden verklaard door het feit dat lokale vestigingen van gezondheidscentra zich hoofdzakelijk richten op het aanpakken van gezondheidsproblemen (oftewel op behandeling) en niet zozeer op het wegen van kinderen als preventieve maatregel.

Wat betreft het significante negatieve effect van sterke *Posyandu* en het significante positieve effect van zwakke en middelmatige *Posyandu* kunnen meerdere

mechanismen hebben meegespeeld. Ten eerste mogen sterke *Posyandu* fondsen of goederen inzamelen onder leden van de gemeenschap, waaronder ook de families met kinderen die deze *Posyandu* bezoeken. Hoewel dit in nauw overleg met de gemeenschap gebeurt en er naar draagkracht wordt bijgedragen, kan dit de moeders ervan weerhouden een bezoek aan dit soort *Posyandu* te brengen en kiezen ze wellicht eerder voor andere soorten *Posyandu* (d.w.z. zwakke of middelmatige) die hun kind gratis wegen. Dit lijkt te wijzen op het belang van de *kosten* in het besluit om een kind te laten wegen.

Ten tweede is hier wellicht sprake van *omgekeerde causaliteit* tussen de sterke *Posyandu* en de beleidscontext. In 2011 kondigde het Ministerie van Binnenlandse Zaken in een verordening aan dat ze zouden helpen bij het versterken van de *Posyandu*. Onze deskundigen stellen dat deze verordening de *Posyandu* wellicht heeft aangemoedigd hun personeelsbestand, servicegebied en autonomie uit te breiden om zo het aantal gewogen kinderen te vergroten, vooral in gebieden waar dit aantal lager was. Het is dus goed mogelijk dat het aantal sterke *Posyandu* in bepaalde gebieden is gestegen *omdat* daar minder kinderen werden gewogen.

Ten derde zouden de onverwachte resultaten in verband kunnen worden gebracht met verschillen in de mate van autonomie van de drie typen *Posyandu* die we onderscheiden. De zwakke en middelmatige *Posyandu* zijn minder autonoom dan de sterke *Posyandu*, aangezien de overheid meer controle over hen heeft en ze nog door gezondheidscentra worden begeleid. Dit impliceert dat er meer controle is op de uitvoering van taken bij zwakke en middelmatige *Posyandu*, wat positieve gevolgen kan hebben op hun weegactiviteiten, ondanks het feit dat ze minder stabiel zijn, minder activiteiten uitvoeren en een kleiner bereik hebben. Er kan hier dus sprake zijn van een *controlemechanisme* waarbij *Posyandu* die meer onder controle staan effectiever zijn in het wegen van kinderen.

De onverwachte bevindingen van deze studie tonen aan hoe belangrijk het is om de coproductie van gezondheidszorg door overheidsinstanties en lokale organisaties te bestuderen en om verder onderzoek te doen naar de precieze grensvoorwaarden waaronder coproductie kan bijdragen aan de gewenste gezondheidsresultaten.

Dissertation summary

Decentralization and community health center performance in Indonesia

What makes health care systems effective in catering to the needs of their populations? This question ranks high on the agenda of policy makers, politicians, and scholars alike. Many countries have put their hopes on decentralization as a means to improve the effectiveness and efficiency of the sector. However, many attempts to assess the performance implications of decentralization remain inconclusive. This is not surprising, since both decentralization and health care systems are complex and multifaceted phenomena and a large variety of factors affect their interplay.

This dissertation aims to shed light on the largely neglected organizational side of decentralization in health care systems: the role of community health centers (CHCs). The assumption thereby is that variation in the structure, composition and management of these front-line organizations strongly affects health outcomes in their respective service coverage areas.

This book contains four empirical studies on Indonesian CHCs and their capacity to generate high performance in health outcomes in the context of decentralization. The focus is on four organizational dimensions of CHC discretion that resulted from the multi-layered decision-space created by decentralization in Indonesia. We relate these dimensions to specific outcomes of CHC activities, leading to the following combinations of organizational dimensions and health care outcomes: 1) CHC decision-space use and innovation; 2) CHC organization design and efficiency; 3) variations in CHC skill mix of professionals and efficacy, and 4) CHC collaboration with community organizations and the number of weighed children. Overall, the central research question in this book is: "How can variation in CHC innovation, efficiency, and efficacy be explained by CHCs' organizational characteristics and social contexts?"

Data and information sources

We retrieved data from various sources on the characteristics and performance of CHCs. We analyzed a variety of documents. For example, we analyzed ***government regulations*** to compare the degree of decision-space and the strength of the accountability mechanisms as well as government regulations regarding the conditions

in which a CHC can have certain structural characteristics, such as a 24-hour emergency unit, or how many skills should be present in a CHC. We studied social media sources containing information on CHC practices, such as ***social media posts***, and also analyzed online job descriptions of various CHC positions.

Expert interviews were used as an additional information collection method. The experts in this study are CHC directors with specific and exclusive knowledge that helped us understand the context of CHCs and how they operate in practice. The interviews were conducted twice: at the beginning of the project and after the results were known.

For the second, third, and fourth studies, we analyzed a ***dataset of 589 CHCs*** operating in Indonesia in 2011. Although this sample amounts to only 6.4% of the total population of Indonesian CHCs, data on health performance are hard to find because of the wide geographical dispersion of CHCs and the under-developed infrastructure of information management systems in the Indonesian health sector. The year 2011 was chosen because it was the most recent for which these two sources had the most information available. We combined both sources to create our sample, retrieving CHC data published on the ***official Ministry of Health website*** and consulting ***37 district health profile reports*** published by the Department of Health. These reports present information per CHC.

Four studies on Indonesian Community Health Centers

The four studies in this book build on the assumption that in order to comprehend CHC performance, we need to consider both the characteristics of CHC as an organization, and characteristics of the health system. Below, we summarize the studies.

Study 1: Community Health Center innovation and decision-space use

The Ministry of Health (MoH) defines national health goals (e.g., reducing maternal mortality in 2005) and strategies. At the organizational level, CHCs have the decision-space to define how they would like to translate the national strategies to organizational strategies and programs. Using this organizational decision-space is expected to enable CHCs to respond innovatively to community health problems and needs, and to tailor services to their specific context. However, the presence of decision-space does not necessarily guarantee that innovation happens. Thus, the central question of the first empirical chapter is *under which conditions does decentralization of the Indonesian public health sector favor innovations at the district and organization (CHC) level?*

We use *a decision-space approach* and theorize that decision-space combined with appropriate accountability mechanisms will lead to innovation practices to improve health performance. Decision-space is defined as a characteristic embedded in CHCs, and the accountability mechanisms refer to the arrangement of relations between

actors in the health system, such as other organizations in different sectors and domains (legislative body).

Indonesia's two waves of decentralization create the opportunity for a detailed comparative examination of how different institutional arrangements may affect health care innovation within the same socio-cultural context. We use the tools of *comparative institutional analysis* to map how key institutional dimensions in the health sector changed from the first to the second wave of decentralization. *Policy documents and administrative regulations* are our major sources in applying this framework to the Indonesian case. Given the paucity of health care innovations in the Indonesian system, we submit the few cases where innovation reportedly did occur to close scrutiny. The purpose of this case analysis is to uncover possible commonalities in the conditions for and the pathways to innovation during both waves of decentralization. Our main data sources for this step are *earlier case study descriptions and media accounts*.

The study has two main findings. First, the decision-space approach proved to be particularly useful to map changes in these particular institutional contexts, because it allowed us to disentangle key decision and accountability domains. Our institutional analysis showed that arrangements during the first and the second wave of decentralization differ considerably, and there is also quite some variation in decision-space and accountability across different domains in each phase. Whereas during the first phase decision-space was broad across most domains, CHC autonomy remained very low, creating a major stumbling block for capacity-enhancing innovation. Since the second wave of decentralization, the institutional framework increased accountability pressure in combination with more decision autonomy with regard to CHC structure and function, but somewhat lowered decision-space in the remaining domains. This combination seems to be favorable for capacity-enhancing innovation at the CHC level.

Second, our case analysis revealed that successful innovation initiatives were often built on the presence and cultivation of cooperative social networks, with both external and internal stakeholders. In the upper echelons, personal connections facilitated lobbying key decision makers in the system. Lower in the hierarchy, social networks of CHC management, health staff and community members contributed to build the trust and commitment that was necessary to carry out the sometimes major restructuring required to implement an innovation. Since networking capacity most likely differs considerably across CHCs, it may be one condition possibly explaining variation in CHCs' innovation potential.

Study 2: Community Health Center efficiency, organization design and context

The MoH also determines the requirements of the need to establish a CHC. A CHC should be present in areas ranging between 30,000 and 60,000 citizens. The central government also regulates the basic organizational structure of a CHC. For example, CHCs are allowed to have branches at the village level, or an inpatient care unit when the next hospital is far away.

At the organizational level, CHCs have the decision-space to propose their structures and allocate their budgets, within some limits. For example, CHCs can expand their structures based on demographic considerations, such as the population size of their service coverage area. The MoH also allows CHCs to have spatial units without limit in quantity. Hence, CHCs can have branches in villages, thereby organizing health care even closer to communities. The same goes for horizontal units, such as a 24-hour care unit or an emergency room, but approval from the upper level institutions is required.

We expect that CHCs will adapt their organizational structures so that they fit the specific context of the service coverage area, resulting in more efficient CHCs, meaning that some CHCs achieve better results with the same input. The second empirical chapter therefore asks: *Is there variation in CHC efficiency in Indonesia, and if so, how can CHCs' organizational characteristics and context explain this variation?*

Drawing on *contingency theor*y reasoning, we apply *a context-design performance framework.* It assumes that structural compatibility with their social context determines CHC efficiency (Marathe, et al., 2007). The concept of structural compatibility refers to a CHC's internal organizational characteristics, particularly its degree of horizontal and spatial differentiation. The social context refers to the characteristics of the service coverage area, such as poverty and remoteness.

We generated technical efficiency scores for 589 CHCs using *data envelopment analysis* (DEA). The study uses *Tobit regression analysis* to analyze the relation between CHC efficiency and CHC horizontal and spatial differentiation, and context characteristics (poverty, remoteness).

The results show that both organizational design and context matter to CHC efficiency. With regard to design, horizontal differentiation, but not spatial differentiation, has an impact in two ways. CHCs with a less diverse *staff mix* (number of functions present in its staff) outperform those with a more diverse staff mix. Furthermore, remoteness matters to the impact of the second organizational design condition, the *number of horizontal units*. Efficiency rates are highest for CHCs with an intermediate number (range 1–2) of horizontal units, but this effect holds only for CHCs in non-remote areas. Furthermore, the impact of the number of horizontal units becomes weaker to the degree that the proportion of poor people increases in a CHC's service coverage area in non-remote areas. This implies that poverty may cancel out the potential efficiency benefits a CHC may realize through keeping an intermediate number of horizontal units.

Although the context conditions *poverty* and *remoteness* affect CHC efficiency, this effect is not direct. This conclusion is particularly relevant from a policy perspective. Being the first study to disentangle the joint impact of two closely related context conditions, a CHC's remoteness and the proportion of poor inhabitants in its service coverage area, our findings show that the socio-economic status of the population in its area does not directly influence CHC efficiency. Furthermore, in non-remote areas, the indirect effect of poverty – in the sense of tempering the efficiency

gains from an intermediate number of horizontal units – is weak. CHCs with larger service coverage areas do slightly better, but this effect is weak. A third context condition has a direct effect: CHCs with larger service coverage areas do slightly better, but this effect is weak, too.

Study 3: Community Health Center efficacy and skill mix of professionals

The Ministry of Health Decree No. 128/2004 lists eight types of health staff professions (skill mix) that must be available in each CHC: doctors, dentists, midwives, nurses, nutritionists, pharmacists, public health officers, and sanitarians or environmental health officers. This range is formally required based on the assumption that these professionals are necessary for CHCs to realize their four basic functions.

CHCs and district offices have the decision-space to propose the inclusion of additional health professions to a CHC. In the collected data (2011), CHC health staff ranges from two to ten professions, with more than 50% of the sample failing to meet the minimally required skill mix of eight professions. This variation in skill mix implies that some CHCs lack the capacity to carry out their four core functions. The research question of the third empirical paper is therefore *which combination(s) of skills (defined as professions) lead to high efficacy in Indonesian CHCs?*

We build on earlier skill-mix research proposing that the variation in skill-mix configuration in a health sector organization can explain variation in performance. This literature also postulates that there are two mechanisms that explain the relation between skill-mix configuration and the performance of health care organizations: *substitution and complementarity* (Buchan & Poz, 2002; Misangyi & Acharya, 2014). We propose that CHCs with a lower skill mix than the standard will still be able to perform optimally due to the substitution mechanism.

We inquire with fuzzy set qualitative comparative analysis (QCA) which combination(s) of skills (defined as professions) lead to high efficacy of Indonesian CHCs. We define four kinds of efficacy indicators, representing outcomes of the four CHC functions: primary health care, mother and infant care, preventing infectious diseases, and health promotion activities. We use the data set of 598 CHCs derived from health profile reports in 2011 for the efficacy variables.

We divide the possible range of staff positions over the four functional domains, depending on who has the prime responsibility to execute the tasks in this domain (based on an analysis of *job descriptions*). Furthermore, we investigate what mechanisms explain the relationship between skill mix and high CHC outputs (efficacy). We analyze job descriptions to derive expectations about which staff members could substitute for each other.

In the CHCs in our sample, the 'standard' skill mix required by the government does not lead to higher efficacy in any of the functional domains. This suggests that a standard skill mix increases coordination costs (Barr, 1995). It could contribute to high quality services, something we did not analyze in this study.

The analysis also suggests that as a mechanism, complementarity is important, given that most pathways require five or six professions in the configuration, and in most configurations professions from multiple functional groups are core or contributing factors. In terms of substitution, we observed *within group* substitution especially, and not so much *between group* substitution, whereas we expected the latter to be more dominant, based on the job profile analysis. We expected nurses and midwives to be key in substituting for other staff, but our analyses show that these professions matter 'only' as contributing and not as core conditions.

Although the analysis did not lead to one pathway to overall efficacy, the various pathways generated share similarities to some extent: GPs, nurses and midwives are contributing conditions; dentists, pharmacists and promotional staff are important – albeit in different compositions. Inductive analyses revealed that the presence of additional health facilities, and especially the presence of an ambulance service, might be an important additional characteristic of the high efficacy CHCs identified by our analysis.

In sum, the various professions in a skill-mix configuration complement each other. The presence of a specialist – such as a pharmacist or dentist – may reduce the workload of the generalist staff such as nurses and GPs. This task differentiation in terms of specialists and generalists seems to be key to achieving high efficacy in certain domains, as shown in our sample. In terms of substitution, we conclude that substituting for staff requires an overlap in tasks and expertise for it to contribute to high efficacy, given that substitution within a functional group is more prominent than substitution between functional groups.

Study 4: The co-production between Community Health Centers and community organizations

Monitoring the weight of children is crucial to detect malnutrition early. To weigh children in Indonesia's challenging demographic and geographic circumstances requires collaboration between CHCs and community-based organizations. This study analyzes this collaboration and its effect on the number of children that are weighed.

Two decrees by the Ministry of Home Affairs and the Ministry of Health in Indonesia mandate CHCs to collaborate with *Posyandu* (community organizations) in providing health care services. *Posyandu* are expected to be present at the neighborhood level, helping CHCs to reach out to the community. CHCs have the decision-space to activate *Posyandu* in order to co-produce health care services with them.

The study categorizes the *Posyandu* in three types, based on the strength of their human resource base, their scope of activities and member base, and their degree of autonomy: strong, intermediate and weak. The fourth empirical paper asks *if and how specific CHC characteristics and the type and number of strong Posyandu relate to number of children weighed in a community,* as an example of one particular health care output (efficacy).

This study builds upon an *organization-community relation perspective* and a *service co-production perspective*. We expect that CHCs that operate in areas with strong community-based service organizations (*Posyandu Mandiri*) will be more effective in reaching the population to have their children weighed, compared to CHCs that do not work in areas with such strong *Posyandu*. However, we assume that the performance in this domain also depends on how well CHCs internally organize themselves to reach out to local communities (Subramony, 2017), particularly in terms of the number of midwives, branches and promotion activities.

Consequently, we propose that the number of children being weighed has a positive relationship with particular characteristics of the CHC (number of midwives, CHC branches and promotion activities) and the number of strong *Posyandu* that co-produce the service. Moreover, we expect a positive interaction effect of CHC characteristics and the presence of strong *Posyandu*. We compiled an archival data set from 37 local government reports on health CHC profiles published in 2011 and applied *negative binomial analyses* to test our hypotheses.

The analysis of the complete sample showed that the three CHC characteristics (number of midwives, CHC branches, and promotion activities) are not significantly related to the number of weighed children under five years old, whereas the analyses of the split sample showed an unexpected negative significant effect of the number of CHC branches on the number of children being weighed in the non-remote areas. These results hint at the relative unimportance – or even potentially counterproductive effect – of these CHC characteristics with regard to the number of weighed children, at least in this sample.

With regard to the importance of *Posyandu* in weighing children, we found a small but surprising negative effect of the number of strong *Posyandu* on the number of weighed children for the complete sample but not for the split sample. Moreover, unexpectedly we found that other types of *Posyandu* – the weak and intermediate ones – are positively and significantly related to the number of weighed children, both in the complete and the non-remote sample. Hence, it is not so much that organizationally strong *Posyandu* facilitate more children being weighed; on the contrary.

Only one hypothesis was partly confirmed, given that the analysis of both complete and non-remote samples showed a (small) significant interaction effect between the number of CHC promotion activities and the number of strong *Posyandu*. This resonates with the idea that this type of *Posyandu* can help strengthen the effect of CHC promotion activities on the number of children being weighed.

The above-mentioned unexpected findings can be explained in multiple ways. First, all *Posyandu*, whatever type they are, have at least one CHC staff member that works with the *Posyandu*. This may not necessarily be a midwife, but another CHC staff member, which might explain the absence of an effect of the number of midwives. Furthermore, regarding the significant negative effect of CHC branches on the number of weighed children in the non-remote sample, it was suggested that CHC branches are

mainly focused on addressing health problems (i.e. cure) and not so much on weighing children as a preventive measure.

With regard to the significant negative effect of strong *Posyandu* and the positive significant effect of weak and intermediate *Posyandu*, multiple mechanisms may have been at work. First, strong *Posyandu* are allowed to collect funds or goods among community members, including the families with children that visit the *Posyandu*. Although this is done in close consultation with the community, and contributions depend on ability to pay, this might make mothers reluctant to visit this kind of *Posyandu* and might make them choose other types (weak or intermediate ones) that provide a free weighing service. This gives hints at the importance of the *cost dimension* in the decision to let a child be weighed.

Second, there might be an issue of *reverse causality* at work in relation to the strong *Posyandu* and the institutional context. In 2011, the Ministry of Home Affairs announced a regulation stating that it would work to reinforce the *Posyandu*. This regulation might have triggered the Ministry of Health and the Ministry of Home Affairs, as our experts suggested, to encourage *Posyandu* to increase their human resources base, scope and autonomy as a way to increase the number of weighed children, particularly in areas where this number was lower. Hence, it may well be that the number of strong *Posyandu* has increased in areas *because* fewer children were being weighed.

Third, the unexpected findings could be understood in relation to differences in the degree of autonomy between the three types of *Posyandu* we distinguish. The weak and intermediate *Posyandu* are less autonomous than the strong *Posyandu* since they are more under the control of the government and still receive training from CHCs. This might imply that there is closer monitoring and scrutiny of the implementation of tasks in the weak and intermediate *Posyandu*, resulting in potentially positive effects for their weighing activities, despite the fact that they are less stable, implement fewer activities and have less coverage. Hence, there might be a *control mechanism* at work here, leading to more effective outcomes with regard to weighing children in those *Posyandu* that are more monitored.

This study's unexpected findings show the importance of studying co-production of health services by public service organizations and community organizations and the necessity to continue with attempts to more precisely define the boundary conditions under which co-production can contribute to desired health outcomes.

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Appendixes

Test of U-shaped relationships and their moderation (Chapter 3)

Testing for U-shaped relationships and their moderation

In addition to two linear main effects, the hypotheses in this study predict two curvilinear main effects, and two moderated curvilinear (interaction) effects. Testing for (moderated) U-shape relationships requires some additional diagnostics, which are outlined in this Appendix 10.1 along the lines suggested by Haans, Pieters & He (2016). Using the results of the full Model (C) in Table 3-7 we first describe how we assessed the presence or absence of a U-Shaped relationship between our two predictors X (organizational design, organizational context), and our dependent variable Y (technical efficiency), and then present the diagnostics we applied to see whether or not this relationship is moderated by poverty (Z).

Testing for U-shaped relationships

Equation (1) represents a dependent variable Y as a function of a linear and a curvilinear main effect of independent variable X. Including the linear main effect is required, because leaving it out implies the strong assumption that the turning point of the curve is at X=0 (Haans et al, 2016:1181):

$$Y = ß0 + ß1X + ß2X^2 \qquad (1)$$

Three diagnostics assess whether or not the curvilinear effect X^2 is significant (Lind & Mehlum, 2010):

1) The value of ß2 has to be significant. Table 3-7 Model C shows significant values of ß1 and ß2 for only one of the organizational design variables, the number of horizontal units. It shows a negative and significant curvilinear effect ($ß2X^2$ = -0.121) between horizontal units and efficiency in non-remote areas.
2) The slope must be sufficiently steep at ends of the data range (i.e. the minimum or the lowest value, XL, and the maximum or the highest value, XH). The relationship is U shaped, if ß1+2 ß2XL is *negative* and significant, and if ß1+2 ß2XH is *positive* and significant. The relationship has an inverted U shape, if ß1+2ß2XL is *positive* and significant and if ß1+2 ß2XH is *negative* and significant. As the test statistics in Table 3-7 shows, the effect of the number of horizontal units on efficiency has an inverted U shape and is significant.

3) The turning point - ß1/2 ß2 should be located well within the data range, i.e. not in the left or right end of the data range. This is indeed the case for the number of horizontal units.

In sum, the curvilinearity diagnostics reveal a significant inverted U-shape relationship between the number of horizontal units and efficiency (see table 10-1 for illustration of calculation).

Test for moderated U-shaped effects

Equation (2) adds a moderation effect (Z) to Equation (1).

$$Y = ß0 + ß1X + ß2X^2 + ß3XZ + ß4X^2Z + ß5Z \qquad (2)$$

A moderation is present if the interaction effect ß4 is significant. If ß4 is positive, the moderator flattens the curve, if ß4 is negative, it steepens it. According to Table 3-7 Model C, only *poverty* significantly moderates the direct relationship between the *number of horizontal units* and *technical efficiency,* and this holds only for non-remote areas. This finding suggests that poverty flattens the inverted U-shaped relationship between the number of horizontal units and technical efficiency. This is in line with Hypothesis 3b.

Table 10-1 Test Statistics for curvilinearity and moderation

Direct effect of number of horizontal units on efficiency (non-remote)		Left side	Right side	Turning point	Interpretation
		ß1+2ß2XL	ß1+2ß2XH	-ß1/2ß2	
Min-max:	0-3	0.281	-0.445	1.161	The left side is positive and the right side is negative form an inverted U shape relationship The turning point is within the minimum and maximum value located about at the second quartile (empirically significant)
ß1	0.281				
ß2	-0.121				
Interaction between number of horizontal units and poverty on efficiency (non-remote)		**Left side**	**Right side**	**Turning point**	**Interpretation**
		ß3+2ß4XL	ß3+2ß4XH	-ß3/2ß4	
Min-max	0-3	-0.007	0.011	1.167	The left side is negative and the right side is positive form a U shape relationship The turning point is within the minimum and maximum value located about at the second quartile (empirically significant)
ß3	-0.007				
ß4	0.003				

Job descriptions of CHC staff (Chapter 4)

Table 10-2 Summary of analysis of job descriptions of CHC staff

Profession	Tasks
Doctors or General Practi-tioners	• Prevent, diagnose & treat illness, disease & injury, for all disease categories & methods of treatment, also continuous & comprehensive care • Responsible for maintaining general health + conducting medical education & research activities • Supervising the implementation of care & treatment plans by other health care providers • (World Health Organization 2012:41)
Dentists	• Diagnose & treat injuries & abnormalities of the teeth, mouth, jaws & associated tissues • Prevent disease • Promote & restore oral health • (World Health Organization 2012:42)
Midwives	• Plan, manage, provide & evaluate midwifery care services before, during & after pregnancy, childbirth, & newborn care • Provide normal delivery care for reducing health risks to women & newborns • Supervise midwifery care plans & conduct midwifery education activities • (World Health Organization 2012:43) • Additional job description, translated from the blog *akreditasi Puskesmas*29 • At beginner level, diagnose illness in pregnant women & infants + Diagnose mouth & dental illness • Provide temporary medication + Help with surveillance of infectious diseases • Visit houses with one family member requiring family care + Monitor the mental growth of infants & toddlers • Help physicians to manage the CHC + Actively stimulate public participation & multi sector collaboration
Nurses	• Plan, manage, provide & evaluate specialist nursing services due to effects of illness, injury, or other physical or mental impairment, or potential risks for health. • May conduct nursing education & research activities in their chosen areas of specialization • May conduct midwifery education activities & provide consultation to other nursing practitioners • (World Health Organization 2012:43) • As translated from the blog *akreditasi Puskesmas*:30 • Diagnose patients with infectious diseases + Provide first medication to patients with dental problem • Provide immunization to infants & elementary school aged children + Inform about healthy living to the patient • Visit the patient's family as follow up when needed + Visit elementary schools & monitor health problems • Provide temporary medication & health information to patient with mental illness

[29] accessed from http://akreditasi-puskesmas.blogspot.nl/2016/04/contoh-uraian-tugas-kapus-dokter-dokter.html, April 16th, 2017 at 17:55
[30]accessed from http://akreditasi-puskesmas.blogspot.nl/2016/04/contoh-uraian-tugas-kapus-dokter-dokter.html, April 16th, 2017 at 17:55

Profession	Tasks
Public health officials	• Plan, manage, provide & evaluate basic public health services for disease prevention & promotion of population health • Manage environments to reduce health risks of the community • (World Health Organization 2012:45). • As translated from the blog *Muh-haris*:31 • Monitor all programs to increase the health status of the community • Design the CHC program in relation to the health problems of the community • Conduct socialization training in the community on how to maintain healthy behavior
Environ-mental health	• Plan, assess & investigate the implementation of programs & regulations to monitor &control environmental factors that can potentially affect water, sanitation, food hygiene, food safety; • Carry out disease investigation & prevention • (World Health Organization 2012:45) • As translated from the blog of *Muh-haris*: • Field monitoring by visiting the houses & public building in the service coverage area (as translated from the blog *akreditasi Puskesmas*) • Coach the community about clean water & usage, healthy toilet, environmental cleanliness, & herbal plantation at home • Help the community to find clean water source & conservation, monitor the hygiene of industry & public spaces
Nutritionist	• Plan, manage, provide & evaluate various dietary interventions, clinical or public health nutrition programs, food safety, food technology or food toxicology programs (World Health Organization 2012: 45): • As translated from the blog of *Muh-haris* • Conduct training about nutrition to the community + Design plans & programs to increase the nutrition status of the community • Coordinate & conduct the technical coaching to the cadre of community based organization
Pharmacist	• Store, preserve, compound, & test & dispense medicinal products • Counsel on the proper use & adverse effects of drugs & medicines following prescriptions issued by medical doctors & other health professionals • Contribute to researching, preparing, prescribing & monitoring medicinal therapies for optimizing human health • (World Health Organization 2012: 41)

[31] accessed from http://muh-haris.blogspot.nl/2015/01/peran-dan-tugas-tenaga-kesehatan.html, April 16th, 2017 at 18:17

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This dissertation aimed to shed more light on the largely neglected organizational side of decentralization in health care systems: the role of Community Health Centers (CHCs). Point of departure for this project is the assumption that variation in the structure, composition and management of these front-line organizations strongly affects health outcomes in their respective service coverage areas. From four empirical studies, the findings suggest that variation in performance remained wide and the organizational dimensions of Community Health Centers matter. Scholars and policy makers may benefit from devoting more attention to this neglected dimension in their future attempts to improve the performance of the Indonesian health care sector.

Suwatin Miharti studied Public Administration in Semarang - Indonesia, Urban Management and Development in Rotterdam - the Netherlands, and Organization Studies in Groningen - the Netherlands. She works as a researcher in the National Institute of Public Administration in Indonesia and wrote some articles on public administration, organization, and management.

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